ENGINEERING NEWS

AND

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ENGINEERING NEWS.

THE PROPOSED RAILWAY TO ALASKA is being actively discussed in British Columbia and the far Northwest, and engineers who know something of the topography of the region to be traversed are considering possible routes. On the south the Spokane Falls & Northern R. R. is now under construction from Spokane Falls, W. T., north to the international boundary in the Kootenai valley. A charter has been secured for a railway in the Kootenai valley from the boundary north to Revelstoke, on the Canadian Pacific, about 200 miles. North of this, along the tributaries of the Columbia, are valuable gold deposits, which have never been largely worked on account of the rigor of the climate and the difficulty of securing supplies. From the headwaters of the Columbia it is proposed to cross to the headwaters of the Fraser, and follow the valley of that stream to Ft. George, thence to the Peace River valley, and thence to the headwaters of the Yukon, the great river of Alaska, which stream would be followed to its mouth near Behring straits. The scheme is an attractive one in its engineering features, for to build a railway for 3,000 miles along the backbone of the continent would give plenty of opportunity for bold achievements and ingenuity in overcoming obstacles. As a route for summer tourists, fond of mountain scenery, it would certainly be unrivalled. As to the vital question, Will it pay? however, it must be said that until there is a prospect of a very much greater local traffic than it seems now possible to secure from any source, the road would be practically a waste of the funds expended in its construction.

THE INTERSTATE COMMERCE LAW has been a thorn in the side of the theatrical profession ever since its passage. A meeting at which nearly all the prominent managers of the East were represented was held in this city May 27 to make arrangements for a presentation of their case to the Interstate Commission. The hope is that the special rates formerly granted them by the railways may be restored.

AN INIQUITOUS PROPOSITION is now being agitated in Connecticut, to make land damages in crossing cases under the law for eliminating grade crossings apply not only to the land bordering on the change of grade, but to "adjacent" property. The effect would be to heavily increase the average cost of such betterments, and as it is now also proposed to throw the whole expense upon the railways, the certainty of abuse is evident.

IN THE IOWA RATE CASES, Judge Brewer has denied a motion to set aside what is known as the June schedule. He wishes the new rates to have a fair trial and says:

If at the end of the time suggested it appears from experience that the Iowa rates do not pay, I shall, unless advised to the contrary by the Supreme Court, permanently enjoin both the first and second schedules, . . . I have good reasons to believe that by the first of next year many questions involved in this litigation will be settled by that court and I see no practical hardship in continuing the cases and the testimony until that time.

THE CHICAGO, MILWAUKEE & ST. PAUL is to have some new blood injected into its directorate at the approaching election, if reports are to be believed. Prominent among the new members will be SAMUEL SPENCER, ex-president of the Baltimore & Ohio and now connected with the banking house of Drexel, Morgan & Co. Other representatives of prominent New York banking houses will be chosen to seats in the Board. In time past there has been a sharp rivalry between this company and the Chicago Northwestern, and both roads have been injured by it. It is thought that the influence of Drexel, Morgan & Co., will be exerted to preserve harmony between the two companies and enable them to share the busines in their common territory without encroaching upon each other.

A FEDERATION OF RAILWAY EMPLOYÉS is to be organized at Chicago, June 3, according to report. It is to include all classes of workers, and the only object it seems to have in view is the coercion of the railway corporations to force them to pay what wages the employés choose to ask. It is very doubtful if the movement will be a successful one. The very different grades of the men whom it is proposed to unite makes any union between them necessarily very brittle. With traffic rates and details of operation fixed by State Commissioners, and the price of supplies and the wages of employés fixed by trade and labor combinations, a general manager may soon be appropriately defined as a man who does *not* manage a railroad.

THE CHICAGO, BURLINGTON & QUINCY Company will pay a quarterly dividend of 1 per cent. to its stockholders on June 15. It is not claimed that this has been earned, but the company still has a considerable mileage of branches built out of the surplus earnings of former years on which it can sell bonds to meet any deficit, a practice perfectly legitimate and for many reasons commendable. A very large proportion of the Chicago, Burlington & Quincy stock is held by small investors and by New England savings banks, who rely on a steady return from their investment. There is every reason to believe that, while the old days of 8 and 10 per cent. dividends on the stock may be long in returning, the property is good to earn an average of 5 or 6 per cent., and with the growth of traffic on the new extensions will soon do so.

A BLOCK SYSTEM is introduced on the Brooklyn Bridge railroad. A series of three signals, like switch targets, at the side of the track is so arranged that an incoming train automatically throws them into view of the train following, and far enough in the rear to enable the second train to stop if necessary until the preceding train has discharged its passengers and moved away from the platform. Two of the targets are green in color, and these signify a warning. The third target nearest the station, is of red, and is a danger signal, not to be passed so long as it is displayed. Of course the signals will not prevent collisions if the brakemen on the trains are careless, but they will warn the brakemen of incoming trains of the danger of a standing train ahead.

THE UNION PACIFIC EXTENSION, from southern Utah to Los Angeles, Cal., is again brought into notice by the filing of a charter in Nevada for the Nevada Pacific railway, which is to run through Lincoln County in southern Nevada and leave the State near the southern corner, running in the direction of Barstow, Cal. The route for the line has been carefully surveyed and work is likely to begin upon it at any time. If the people of Los Angeles and Salt Lake City would cease their attempts to form an independent company to build a road connecting the two cities on an "air line" route, and would give a portion of the money they propose wasting on useless wild-cat schemes to further this enterprise, they would have railway connection with each other in a few months.

ANOTHER GENEROUS GIFT from Mr. HENRY W. SAGE, who has already done so much for Cornell University, ensures the University $200,000 to pay for the splendid library building begun on the strength of the MCGRAW-FISKE bequest of $1,500,000, which ex-Professor FISKE is now so unworthily seeking to invalidate, and $300,000 additional to support the library. If the bequest mentioned is retained by the University, the $500,000 thus given will probably still go to the University for other purposes, making the total of Mr. SAGE'S gift $1,000,000 in cash, besides his invaluable counsel and services.

THE FIRST-CAR HEATING PENALTY, for carrying stoves in cars contrary to law, was adjudged against the New York, New Haven & Hartford R. R. last week, the Supreme Court of New York adjudging a $7,000 penalty. This "Supreme" Court is not supreme, however, and the case will probably be carried to the Court of Appeals.

THE BOYNTON BICYCLE RAILWAY CO. will open a short experimental line at Coney Island about July 1. They are said to be about to build two new and heavy engines, with 20in. cylinders *and* 10 *to* 12 *ft. drivers!*

SUBSURFACE FLOATS are to be set adrift, by order of Lieut. PILLSBURY, for the purposes of the U. S. coast and geodetic survey. These floats will be made of a 1½ in. square, white-painted pine staff, about 8 ft. long. This staff will project from one to two feet above the surface and be surmounted by a simple tin vane and with four galvanized sheet-iron wings at the lower end to receive the impulse of ocean currents. The staff carries five glass water-tight tubes each held in a mortice by a copper wire. Each tube encloses an envelope addressed to the department at Washington and containing a leaflet of instruction to the finder in German, Spanish, and French. The finder is supposed to break open a tube, fill the blank noting position etc., of the float, forward this form to Washington, and to set the float again adrift.

THE MOST SERIOUS RAILWAY ACCIDENT of the week, was the derailment of a passenger train May 24, on the St. Louis & San Francisco Railway, near Sullivan, Mo. The accident was caused by train wreckers who had drawn the spikes and removed the splice bars at a curve. The locomotive, baggage car and 5 passengers cars went down a 30 ft. bank, but although 45 persons were more or less seriously injured, none were killed. The cars were badly wrecked.——Another serious accident was a head collision between a special freight and a regular freight on the Housatonic Railway, May 28. Two men were killed and 2 injured. The accident was caused by a disobedience of orders on the part of the driver of the regular train, who was directed to get orders from the operator at Stepney; the operator had orders to stop this train, but is said to have been asleep when the train came, and the driver instead of getting his orders took his chances to proceed.

THE FOLLOWING BRIDGE ACCIDENT occurred May 23: The Housatonic river bridge at Lenox, Mass., gave way under a team, and one man was killed. According to the Springfield *Republican*, the bridge, which was a one span wooden structure, 66 ft. long, had been known for some time to be in a dangerous condition, and at the last town-meeting money was raised for its repair. This work was begun on the previous Wednesday by the placing of a few new planks on it. An examination of the bridge after the accident showed that the string pieces on both sides were rotted entirely through, and the only wonder is that it had held so long. The bolts pulled through the rotten wood, when the strain came upon them, and the whole section of flooring gave in.——It is likely that there are many other old wooden bridges in unsafe condition, and the Freeholders of Camden County, N. J., held a special meeting recently to take action on the unsafe condition of the county bridges.

THE NEW YORK & UTAH LAND AND IRRIGATION CO. is making surveys for irrigating a large tract of land on the Bear river, in Utah. Mr. JAS.

D. SCHUYLER is consulting engineer for the company, and in an extensive report speaks favorably of the project, especially congratulating the company that the river flows through the finest unirrigated land in the territory, that the stream is so large, and that the scheme will afford fine water power at many points.

Originally, it was intended to confine the irrigation to the west side of Bear river, taking the water out on that side of the cañon, carrying it westward across the Malad river, and thence to the south, along the foot-hills, to the lake west of Little Mountain. The intention now is to carry water down the east side of the river, along the foot-hills of the Wahsatch range, to Brigham City, Hot Springs, and Ogden.

Plans, specifications, and estimates for the west side of the river have been completed; and when the surveys now in progress on the east side are finished, it is hoped that the first contracts for the work will be let. The cañon and hillside work will probably be done first. Mr. SCHUYLER's estimates, thus far, place the cost of the work at $1,500,000.

CROTON WATER is not so bad as a clipping from a New York exchange led us to announce in our issue of May 18. In fact, a careful study of the report of the State Board of Health, since received, shows that they actually say just the reverse of what was then quoted. Instead of being worse than in years past, the water is better in 1888 than in 1885, taken on the general average.

THE MONTREAL HARBOR BOARD has adopted for flood protection dams one of the plans proposed by the Harbor Engineer, Mr. JOHN KENNEDY, and the City Engineer, Mr. P. W. ST. GEORGE. This plan would give nearly 10,000 ft. of additional wharfage between the Lachine Canal and Victoria pier, says the Montreal *Star*. At Hochelaga 10,000 lin. ft. of wharf would also be secured. The committee report referred to a plan proposed by a committee of citizens, and approved in 1859 by the late JOHN C. TRAUTWINE, C. E., which provided for the formation of a dock contiguous to and connected with the Lachine Canal at a level above floods, and entered from the present harbor by one or more locks. Without endorsing this plan in its detail, the committee thought that a large extension of the deep-water basins in the Lachine Canal would be at once a simple, cheap, and most valuable addition to the harbor facilities.

PROPOSALS FOR THREE NEW CRUISERS have been asked by the Navy Department, bids to be opened on August 1. These vessels are to have 2,000 tons displacement each and are to exhibit a maximum speed of 18 knots per hour for four consecutive hours. They are to be finished in two years. Exclusive of armament, they are to cost $700,000 each as a maximum.

THE CHICAGO DRAINAGE BILL, which has already passed the Illinois Senate by a vote of 32 to 18, has now passed the House by 96 to 38. It now awaits the Governor's signature, and no one seems to question its final approval. It practically means the expenditure of about $18,000,000 by the city of Chicago upon a combined drainage and ship canal.

LOCOMOTIVES of three novel types are running on the trunk lines,—the English locomotive on the Pennsylvania, the Strong locomotive on the Erie, and the Shaw balanced locomotive on the Baltimore & Ohio.

THE WESTINGHOUSE-EDISON ELECTRIC CASE, which will undoubtedly be one of the famous cases of the decade, was commenced in Pittsburg last week. The case was opened by the lawyers on the issue of bamboo carbon loop vs. a straight carbon. The case promises to be interesting and lively.

IMMIGRATION was 62,605 in April, 1889, against 79,670 in April, 1888, a decrease of 22 per cent. The 4 months ending with April show a decrease of 22½ per cent., and the 10 months ending with April show a decrease of 14¾ per cent. Emigration from Italy has enormously decreased, to less than one-fifth of what it was a year ago, for which we have every reason to be thankful. Emigration from Germany shows an increase.

A GARBAGE CREMATOR, on the Vienna system, is recommended by a special committee of councils for adoption in St. Paul, Minn. The owner of the American patent is Mr. H. G. FLEISCHMANN, of New York, who offers to construct and operate a plant similar to the one at Buffalo, N. Y., for $15,000 per annum. The cost of construction will be something less than $100,000 for a capacity of 60 tons of garbage daily.

THE SUEZ CANAL, in 1888, had a total traffic of 3,440 vessels with a gross tonnage of 9,437,957 tons. The record for 1887 was 3,137 ships with 8,430,043 tons. The revenue of 1888 collected was £2,593,291, as compared with £2,314,494 for 1887. Of the vessels using the canal, 2,625 were British, 187 French, 146 Italian, 163 German, and 121 Dutch; all other nations were under 100 ships. Of the 3,440 vessels, 1,608 went through at night.

A MODEL LINK AND VALVE MOTION, for use at meetings of railroad associations and clubs, in drafting rooms, etc., has been designed by Mr. W. H. ERMENTROUT, of 141 N. Fifth St., Reading, Pa. With this model a valve motion of any dimensions can be set up and tested in a short time, as all of its parts are adjustable. They are made of hard wood, accurately and finely finished, and cost $15 each.

THE SUKKUR OR LANSDOWNE BRIDGE, recently erected over the river Indus, has a main span made up of two cantilevers of 310 ft. each and a suspended truss of 200 ft., making a total span of 820 ft., the longest of its character in the world. The *Indian Engineer* says that in this long span, weighing 3,300 tons, the expansion between the abutments amounts to nearly 8 inches, and the nose of the cantilever moves horizontally up and down stream about 2 inches in the course of each day as the one side or the other of the bridge is exposed to the direct rays of the sun. This bridge has, besides the great span, three others of 278 ft., 238 ft., and 94½ ft. respectively, of ordinary girders resting on piers founded on the rock. Work was commenced in 1883-84, and all except the main span was finished in March, 1885. The staging for the main span was started Jan. 18, 1889, and finished Jan. 30; erection was commenced Feb. 5. The engineer was Sir A. M. RENDEL, and the builders were Westwood & Baillie, of Poplar, London. The total cost of the whole bridge was $1,528,800. It carries the Indian State Railway over the Indus river.

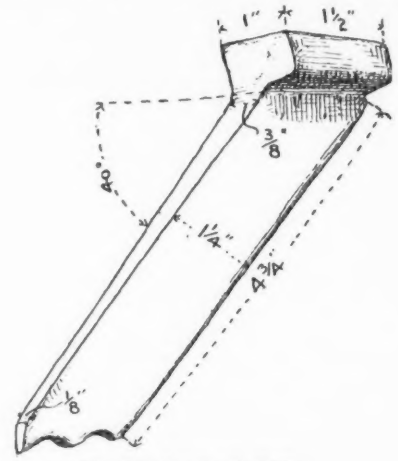
AT THE MERCHANTS' BRIDGE, at St. Louis, the West Shore Pier, No. 4, has reached bed-rock; two more caissons are completed and on the launching-ways awaiting a rise in the river, and the fourth caisson is approaching completion. So says a correspondent under date of May 20.

THE PROPOSED WALNUT ST. BRIDGE in Philadelphia has been approved, as far as the crossing of the Schuylkill river is concerned, by the Secretary of War.

A NOVEL FEATURE IN SUSPENSION BRIDGES is illustrated in the *Pacific Lumberman*, as having been lately first introduced by the Pacific Bridge Co. in a suspension bridge built at Oregon City, Ore. The bridge is 466 ft. in span between towers, and 820 ft. long over all, with 75 ft. in the clear under the floor, and towers 90 and 100 ft. high respectively. The novel feature is the introduction of self-adjusting or counter-balanced reversed cables, to add to the stiffness of the bridge. Instead of running to a fixed anchorage, the ends of each cable pass over a pulley placed between two heavy iron beams spanning a well. The axis of the pulley is caught by two eye-bar anchors fastened to the rock. The end of the cable itself passes over the pulley and through a 10,000-lb. block of concrete resting on a flanged cast bottom plate with the cable end secured to this plate. These counter-weights keep the cable under a constant strain, due to the weight of the blocks, and overcome vibrations from teams. But any greater strain than 10,000 lbs. is taken up by the special anchors referred to, as there is a stop on the main cable which serves to throw the strain in the direct line leading to the anchors.

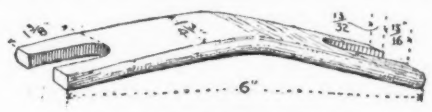
The Davies Lock Spike and Nut-Lock.

We illustrate this week a form of railway spike which is a considerable departure from the ordinary form. It is a broad flat spike, with the shank at an angle of about 45° with the head; the sides of the head are diagonally parallel, but are not vertical, making an angle of about 20° with the vertical line. The spike is driven diagonally into the tie, parallel with the rail, and the head being of extra width gives a good hold on the flange. It is 1¼-in. wide, with a head 1½ in. long by 1 in. wide; the thickness tapers from ¾-in. to ⅛-in., and there is a length of about 4¾ ins. in the tie. The angle of the



The Davies Lock Spike.

point is for the purpose of causing the spike to drive properly, while the cutting edges of the two grooves are to prevent the tearing of the fibres of the wood. Two spikes are used to each rail, sloping in opposite directions, and it is claimed that the passage of trains will not draw them, but that they will maintain a firm hold on the rail for a much longer time than the ordinary spike. The width offers considerable resistance to lateral thrust, and for curves it is proposed to use a still wider spike, about 1⅝ ins. wide, and to dispense with rail braces. In connec-



The Davies Nut-Lock.

tion with the Servis tie-plate, which would cause the two spikes to act together, a very firm fastening would be made. Mr. J. CHURCHWARD, 12 Cortlandt St., New York, is assistant manager of the company; and the Dunham Mfg. Co., of 131 Devonshire St., Boston (which supplies the Servis tie-plate), has the agency. They are manufactured by the Cambria Iron Co., of Johnstown, Pa.

These spikes have been in service for some months, and as an indication of the results of experience we give below the opinions which some railway men have expressed:

Mr. G. E. DAGGETT, Bridgeport, Conn., road-master of the New York, New Haven & Hartford, says: "My opinion would be that for sharp curves, and places where there is a quick and heavy strain or pressure upon the rails, they are a great improvement, as they hold the rails firmly to the ties."

Mr. J. B. MULLIKEN, of Detroit, Mich., general manager of the Detroit, Lansing & Northern, says: "The sample lot are giving such good results we think very strongly of adopting them for use on curves and heavy grades."

Mr. C. HAMILTON, of St. Louis, Mo., superintendent of the Mobile & Ohio, says (Nov. 24, 1888): I examined Sugar Creek curve a few days ago where the spikes you sent me were used, and am very much pleased with the result. It is an 8° curve at the foot of a hill, and the rails are subject to a very severe strain by the passage of our heavy Consolidation engines. I found that the rails had not moved since the spikes were put in, in August last, and prior to this, this same curve had been spiked with the ordinary spikes and rail braces put on, but notwithstanding this the rails had been crowded out about ¼-in."

Mr. W. J. MCMILLAN, Mason City, Ia., road-

master of the Mason City & Fort Dodge, says: "I have tried them on a 16° curve, and where they were driven in sound ties they have given good service. They are giving better satisfaction to my foremen than the rail braces that we are now using."

Mr. THOS. L. DUNN, New Albany, Ind., chief engineer of the Louisville, Evansville & St. Louis, says: "The spikes sent for trial were put in on a 6° curve around which switching as well as regular trains are run. They have done good service so far, and I do not think braces would be needed on curves where the spikes are used."

The Davies nut lock, which we also illustrate, is one of the simplest and cheapest forms of nut locks yet brought out, and it is said to have given much satisfaction in experimental service. It is merely a bent piece of ¼-in. steel, 6 ins. long and 1¾ ins. wide. The slots engage with the splice bolts, and the nuts are screwed down on the projecting ends, forcing them flat against the splice bar. The lock is so simple that we should judge it well worthy of a trial. It is supplied by the same firms who supply the lock spikes.

The Pawtucket, R. I., Water-Works.

GENERAL DESCRIPTION.

The water-works at Pawtucket, R. I., were built in 1877-9 by the city. Since then the system has been extended to supply the adjacent towns of Berkeley, Ashton, Central Falls, East Providence, Lonsdale and Valley Falls. The distributing system in East Providence was put in by that village, Pawtucket taking possession at its completion, and paying a rebate of 25 per cent. of all rates collected. Central Falls still owns and manages its distributing plant, but receives a rebate of 40 per cent. of all evenues collected by Pawtucket. In all the other towns the plant is owned and managed by Pawtucket. Over half of the population supplied lies outside of Pawtucket, making this city the most noteworthy instance of a municipality supplying water outside its own limits.

The water supply is from Abbott's run, by pumping from an impounding reservoir, through the distributing mains, to a distributing reservoir.

Since the works were built in 1879 two new pumping stations have been built on Abbott's run below the old station. The first pumping station has a daily capacity of 3,000,000 galls., the second the same, and the third, of 6,000,000 galls. The pumping engines are all of the Corliss pattern. In 1888, No. 1 made an average daily duty of 124,512,184 ft. lbs., which is certainly one of the best records ever made in the United States. The pump was put in operation Jan. 31, 1879, and has been in constant use ever since. At Station No. 2 both water-power and steam are used. The 6,000,000-gall. pump at Station No. 3 was built in 1888, and is of the same general style as the first pump.

THE DAM AT DIAMOND HILL RESERVOIR.

The impounding reservoir is close by Pumping Station No. 1, and is known as Happy Hollow pond. A dam on the stream above, first filled in February, 1888, forms the Diamond Hill storage reservoir, which has a capacity of 1,600,000,000 galls. This is the largest reservoir in the New England States, except the Cochituate reservoir, or lake, of the Boston water-works, which has a storage capacity of 2,011,000,000 galls.

We present herewith a longitudinal section of the dam, a section through the gate chamber, and another through the highest part of the dam. The total length of the dam proper is 1,050 ft.; its greatest height is 45 ft., and the water at the highest part is 40 ft. deep. By referring to Figs. 1 and 3, it will be seen that beneath the whole of the dam the natural earth, a black muck, was excavated for several feet and filled with puddled clay, The general depth of this excavation was 6 ft.

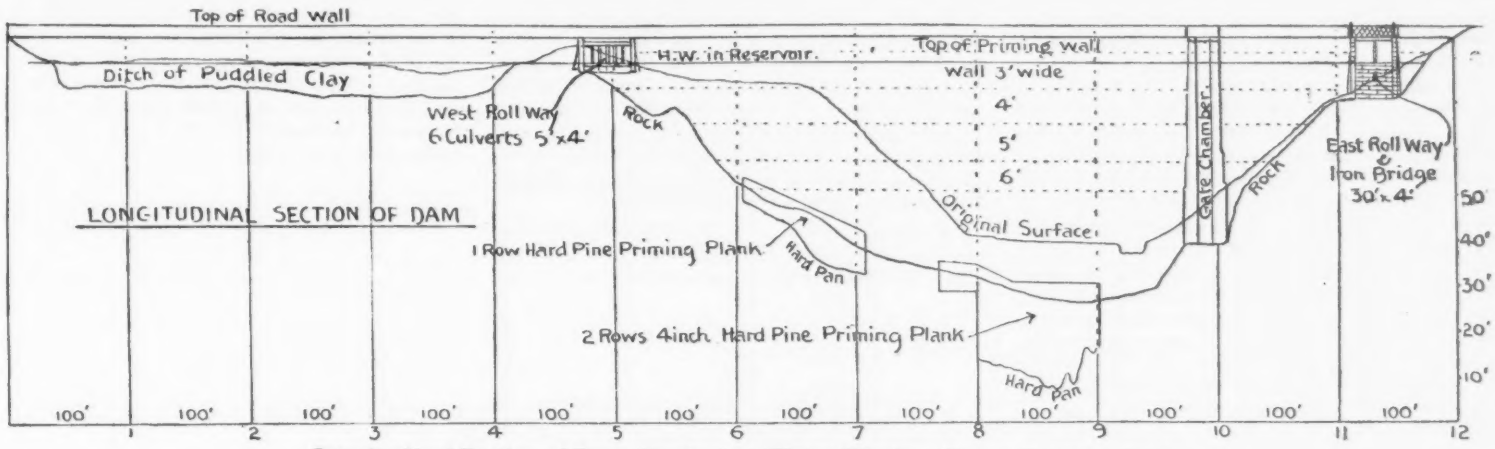
The dam has a heart-wall of rubble masonry, resting on a concrete foundation, the general arrangement of both being shown in Fig. 3. In the higher part of the dam, where rock could not be reached, sheet piling was used as is shown by Figs. 1 and 3. In the latter a row of 2-in. plank is shown as driven at each side of the concrete, and two rows of 4-in. plank, 7 ft. apart, below it, the latter reaching to hard gravel bottom. On the water side of the heart-wall is a wall of puddled clay, 10 ft. thick.

The dam is 27 ft. thick on top, where there is a roadway guarded by a masonry wall. The outer slope of the dam is 1½ to 1, and the inner, 2 to 1. The outer slope is sodded, and the inner paved.

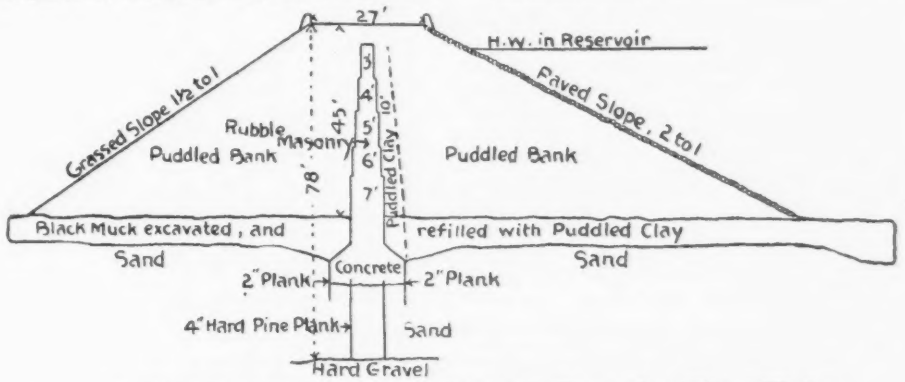
The gate-chamber, shown by Fig. 3, is 10 ft. sq., with walls 11 ft. thick at the bottom and 6 at the top. Two 30-in. pipes lead from the gate-chamber through the base of the dam.

There are two waste-ways, that at the east end being 30 ft. long and 6 ft. high, with an iron bridge across it, and the one at the west end consisting of six openings, or culverts, 5 ft. wide by 4 ft. high, with 2 ft. of stone between.

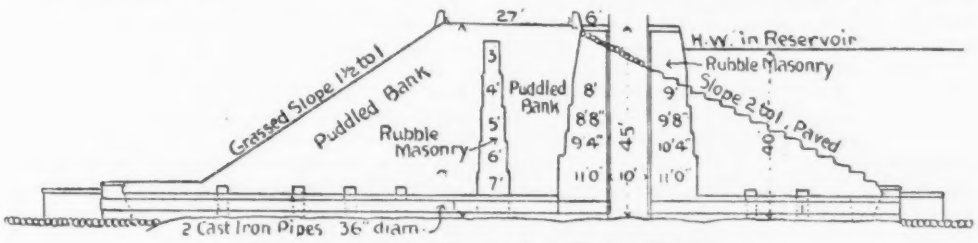
The material used in the dam and the labor done, together with itemized cost of same, was as follows:



Longitudinal Section of Dam, Pawtucket Water-Works. EDWIN DARLING, Supt.



Section of Dam through Gate-Chamber, Pawtucket Water-Works.



Section of Dam, Pawtucket Water-Works.

	cu. yds.
Earth.—Total used, all puddled, average haul, 1,200 ft.	94,000
Used for new roads, etc., ave'ge haul, 587 ft.	9,400
Muck and sand excavated from foundation of dam, and wasted, average haul, 300 ft.	12,522
Sand spread on muck flats, av'ge haul, 300 ft.	685
Loam moved to points above high water line, average haul, 250 ft.	1,250
Total earth moved	117,857
Ledge Rock.—Total moved, average haul, 835 ft. This was used in cement work, dry walls, riprap, crushed for road material, and wasted.	7,480
Dry Masonry.—From local farm walls; total used for road walls	2,654
Stone Walls Moved.—Used same as ledge rock, above; average haul, 2,500 ft.	5,704
Cement Masonry.—Of rubble, from local ledges	5,953
From farm walls	900
Quarry rubble, at $2.50 per cu. yd., delivered	172
Quarry cut granite, at $16.97, per cu. yd.	203
Total cement work	7,228
Cement.—Total of 7,071 casks used.	
Grubbing.—Area, 13.6 acres	21,912
	sq. yds.
Riprap.—From stone walls and local ledges; average haul, 500 ft.	1,470
Paving.—Total slope paving	4,677
Below draw-off pipe	550
Total	5,227

Houses Moved.—Four farm-houses, moved an average of 1,450 ft., and new cellars built. Excavation, 406 cu. yds.; dry wall, 153 cu. yds.; brick-work, 34 cu. yds.

TOTAL COST EXCLUSIVE OF LAND DAMAGES.

Pay rolls, including engineers in 1885-6	$71,862.42
Gloucester Iron Works, for 36-in. pipe under dam	3,428.38
Coffin Valve Co., valves $1,292.75; iron bridge $450; Total	1,742.50
Granite, $3,900; rubble, $1,350; cement, $8,500 Total	13,750.00
Spruce plank, $660; hard pine plank, $1,100; general lumber, $80; total	1,840.00
Use of engines, etc., pumping water	1,466.00
Dredge work	1,805.50
Total cost of dam	$95,887.05

THE FILTER GALLERY.

At Station No. 3 there is a new filter gallery, 103 ft. long by 20 ft. wide, or with a surface area of 2,060 sq. ft. The first 18 ins. of the filter bed is of stone of various sizes, the largest being 2 in. in diameter. Above this is 1 ft. of brick and maple-charcoal, then 18 ins. of stone, graded to the size of pea-gravel at

the top. The bed rests on an iron grating, formed by 3 by $\frac{1}{8}$-in. iron bars on edge, with openings $1\frac{1}{8}$ in. between them. The bars rest on 7-in. rolled beams, $5\frac{1}{4}$ ft. apart, supported by brick piers. Water is admitted from below, a 36-in. supply pipe bringing it to a receiving well the width of the gallery, from which it passes beneath and up through the bed.

When in operation there is about 5 ft. of filtered water above the filter bed, which water passes through overflows to three wells, and from them by 30-in. pipes to as many pump-wells.

This gallery is supplied from the dam at Happy Hollow pond, a few feet above, through a 36 in. pipe. Arrangements exist for feeding the other stations from this gallery, also for feeding them from the old filter at Station No. 2, or for feeding any or all of the stations with unfiltered water.

The old filter was much like the new, but without charcoal. It was designed to free the water from fish, spawn and inorganic matter of comparatively large size,and it served its purpose well. The new filter removes nearly all matter in suspension, and it is claimed that it also removes a large percentage of micro-organisms.

The washing is a simple process. The supply being shut off, the current is reversed and the filtered water passes down through the filter-bed, and into the stream through discharge pipes provided with gates, taking with it the impurities collected. When the water has all passed out, hose are attached to a pipe running through the gallery, above the bed, and water at a pressure of about 40 lbs. is played on the surface of the filtering material. When this washing begins, if a handful of the gravel is taken up the hand will be soiled. The washing is continued until the gravel is clean, and will not soil the hands.

As high as 10,000,000 galls. a day sometimes pass through the filter, or 3.4 galls. per minute p er sq. ft As the water must pass up through 4 ft. of gravel and charcoal in this time, the filtering process is very rapid, and it seems probable that the charcoal acts in much the same way as the stone, water passing around and not through it. However this may be, the quality of the water is much improved, and the results with the charcoal are said to be better than in the old filter, without charcoal.

The filter has been in operation but a few months, and while it evidently fulfils the purpose for which it was constructed, a year's trial, at least, is needed to demonstrate its entire success, especi ally if the claims for the removal ot any considerable number of micro-organisms are to be tested.

The cost of the filter gallery was $5,000. The charcoal cost about $500. The washing is done by the regular employés at the pumping stations, and therefore at no extra cost. The highest interest paid on the water bonds is 5 per cent., making the annual interest on the investment but $250. The water being quite free from sediment and passing the filter so rapidly, the charcoal need not be changed oftener than twice a year, which would cost $1,000. Thus the actual cost of the filter per year would be but $1,250. In 1888 about $80,000 in water rates was collected from consumers, so the cost for filtering the water was but 0.156 per cent. of the total rates collected, or for every 64 cts. paid by consumers one cent went for filtering the water.

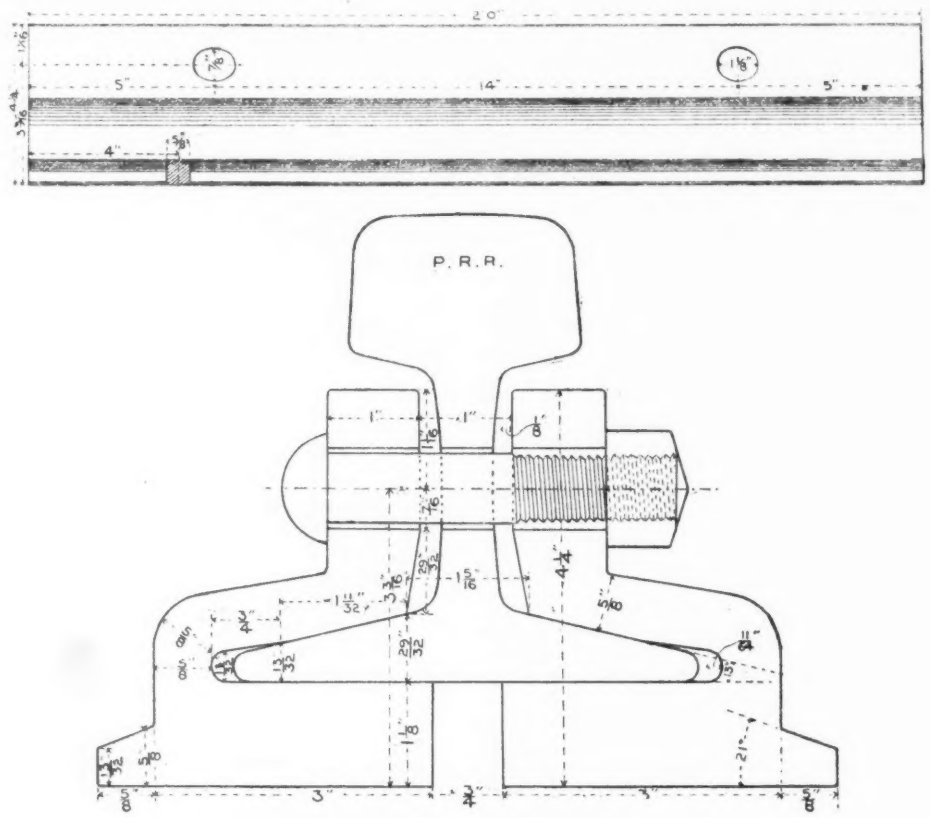
The Thomson Rail-Joint.

We illustrate herewith a joint designed 2 years ago by Mr. M. W. THOMSON, Engineer of Maintenance of Way of the Pennsylvania Railroad, to meet if possible the extraordinary requirements of the present traffic. As first designed, there were two bolts passing under the rail through the base of the joint, in addition to the two bolts passing through the web. The joint as now used, however, has only the two upper bolts. It is simple in construction, and not only gives the rail a base bearing but is also claimed to have three or four times the strength of the ordinary angle splice, a claim which seems to us of doubtful soundness.

The joint is shown applied to the 85-lb. rail of the Pennsylvania Railroad, on which road about 6 miles have been in the track during the last year, and the reports have been very favorable. The weight is 98 lbs. per pair. The Chicago & Northwestern put in 400 pairs last year, and has given an order for 20,000 pairs for its new 72-lb. standard rail; the weight will be 80 lbs. per pair. The St. Louis & San Francisco, and the Flint & Pere Marquette roads are also each putting in a couple of miles. The joint has been fairly well tried already, and the present indications seem good that it may come into extensive use.

Whether it is really the final word on the joint question is more doubtful. It will be seen that it is a very radical departure, and abandons completely the most prominent feature of the fish-plate type of joint, the support of the rail from beneath the head. The support is purely a base support, like that of the Fisher joint, but with the added feature of a lateral compression, holding the rails firmly in line, the lack of which in the Fisher joint is a not infrequent objection to it, although we are not yet clear by any means that it is a sound objection.

On the other hand, the joint necessarily sacrifices the "bridge" or upward camber feature of the Fisher joint; by which the main support of the rail is close to the ends and a nearly even and constant distribution of the load between the two joint ties is assured during the entire period of the passage of the wheel over the adjacent rail ends. This we cannot but regard as a serious loss. That feature of the Fisher joint is thoroughly scientific and mechanical, and seems a necessary one for an ideally perfect joint, if that were attainable.



The Thomson Rail Joint.

Like the Fisher, this joint requires the two joint ties to be depressed $1\frac{1}{8}$ ins. below the others, which is slightly more than the Fisher needs. This has often been made an objection against the Fisher, and it will be against this, although we cannot see that it is likely to do much harm.

As to the omission of a lower bolt first used, the proof of the pudding is in the eating thereof, but we cannot see how at least one bolt through projecting lugs under the joint can be advantageously dispensed with. The two bolts now used act at great disadvantage in bringing up the base to a bearing, although their action may be helped somewhat in screwing up, by light taps of a sledge. Without some such adventitious aid we cannot see how it can be possible to screw up the joint so that it will not be more or less loose even when the wrench is first removed.

The idea is, evidently, that the upper legs of the joint will by their spring act of themselves as a nut-lock, dispensing with any separate appliance, and the idea is ingenious. With a lower bolt this spring ought to suffice to lock the nut; but without it, the spring action would seem likely to be largely at the expense of a tight fit about the base, and we should fancy that the nut would still be likely to work loose; or be more likely to do so than with a lower bolt also, but it evidently reduces cost considerably to omit the lower bolt.

These are some points which occur to us about the joint, which offers many striking features and seems a most promising experiment. We have long been disposed to believe that "the fish-plate must go" eventually, as an essentially unmechanical way of supporting the rail ends. The difficulty has been to devise and agree upon a substitute. Reason and analogy point to a base support as the proper point to start with for any joint which is to be an improvement on angle-bars. This joint has that and many other good points.

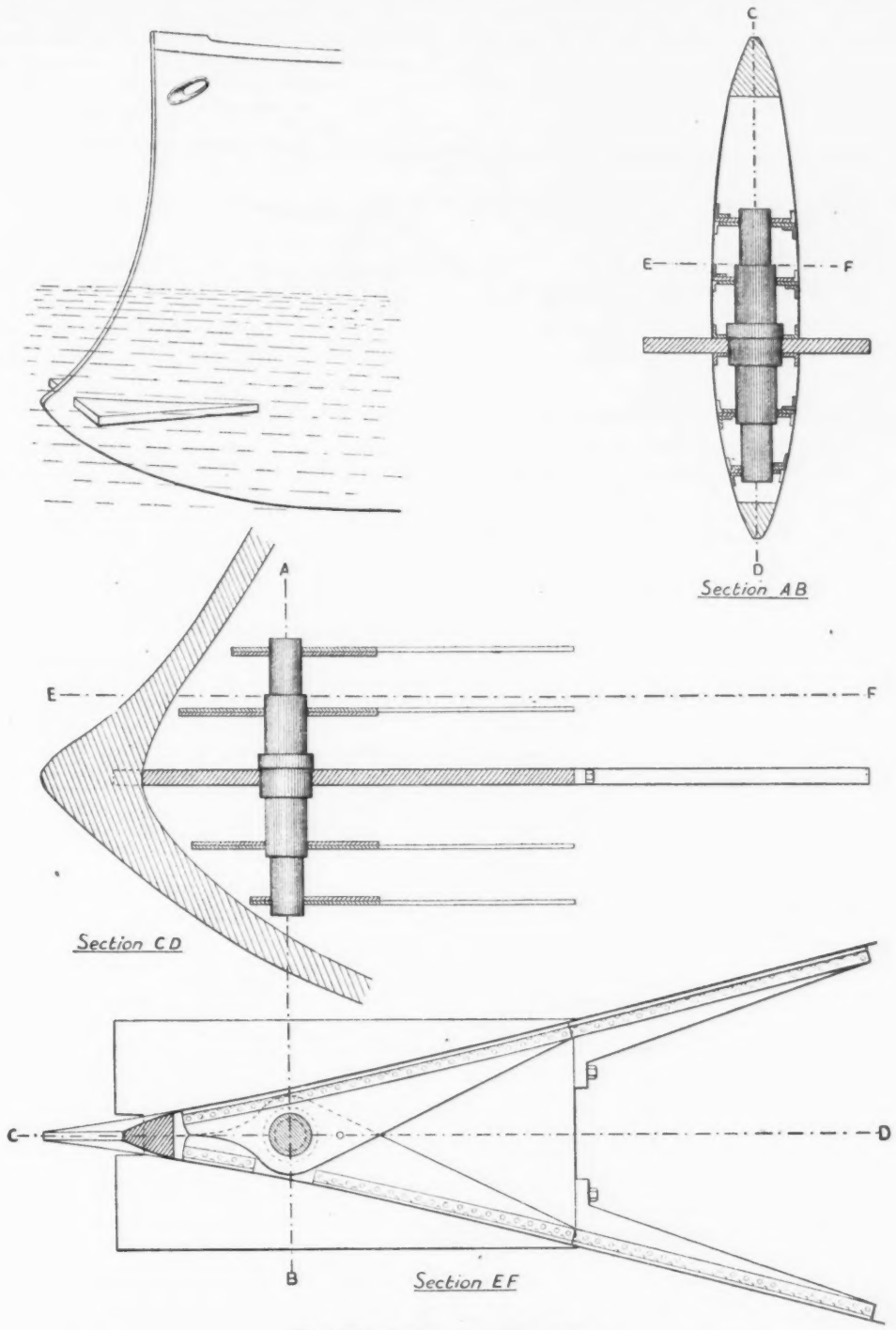
THE INTERSTATE COMMERCE COMMISSION has published its proceedings in two recent cases in which the railways of the South are especially interested. The first was an inquiry, instituted by the Commission, into the extent to which the various carriers of the Southern States were obeying the long and short haul clause and the clause relating to the publication of tariffs. The Commission finds that the long and short haul clause is very largely disregarded in the South, and it urges the companies to remodel their tariffs at an early date in accordance with its provisions. The present great disparity in classifications in force is condemned, and it is urged that the published tariff be simplified and adhered to.

The second case was a complaint brought by a colored man against the Georgia Railroad, claiming a discrimination against him on account of his race, in that the car in which he was obliged to travel, although he was the holder of a first-class ticket, was inferior to the ordinary first-class cars in use on the road. The Commission decided the act in question to be an unlawful discrimination, and as such an infraction of the law. The Commission, in its opinion, declares that equal accommodations must be furnished for equal fares, and that equal protection must be extended to all passengers alike without regard to the amount of fare paid.

THE CEDAR-BLOCK PAVEMENT, put down in St. Paul, Minn., in 1882, now shows an average wear of less than 2 ins. under heavy traffic. Recent investigations show that the blocks are in a perfect state of preservation, but the one-inch planks beneath the blocks exhibit the effects of seven years pounding. Two-inch planks are now used.

The Ward Ram for War Ships.

The ram here illustrated for use on war vessels is the invention of Mr. JOHN F. WARD, M. Am. Soc. C. E., of Jersey City, N. J. Ships' rams, as usually constructed, present a sharp, vertical cutting edge with comparatively little horizontal width. Such a ram, by striking squarely the side of an enemy's ship, may doubtless inflict much damage: but there is also great danger of wrenching off the ram of the attacking ship, by reason of a glancing blow or the swinging action of a strong current, or of so straining the frame of the attacking vessel that the ram would be practically valueless for further service. The experience gained during the late civil war has induced no less an authority than Admiral D. D. PORTER, in the *North American Review* of February, 1889, to declare that "no ship has yet been constructed that would serve the purpose of a *ram*, —that is, could run with great speed into an enemy's vessel and sink her without material damage to herself."



The Ward Ram for War-Ships.

The present device is intended to overcome the inherent disadvantages of the older form, and it accomplishes this end by a departure from former practice as radical as it is simple. Instead of a vertical plane of attack, we have here a horizontal ram, with projecting ends extending transversely through the bows of the war-ship and presenting on either side of the stem an attacking angle of strong and heavy iron plate, so located as to strike below the water-line and to be effective at almost any angle of approach. The most dangerous blow of all to an enemy with this ram would probably be an almost parallel glancing attack which would tear a long, narrow path through the plating of the enemy's ship and rupture any frame in the track of the ram. A hole of this nature would be most difficult to stop and would, to a considerable extent, cancel the advantages of water-tight compartments in a war-vessel.

The drawings show the ram as arranged in the bow of the ship, though of course this arrangement might be modified at the will of the naval constructor, and in accordance with the type of vessel upon which it is to be used. The plate as shown here is about 6¼ ins. thick, and about 8 ft. wide, and 16 ft. long. Through the forward half of this plate passes a steel shaft about 24 ins. in diameter, which is further braced 2 ft. and 4 ft. above and below the main plate by other stiffening plates, about 1½ ins. thick, strongly secured to the sides of the ship by angle-iron; and the main plate is also in like manner connected with the ship's sides. The purpose of this steel shaft and the supplementary plates is to transmit the strains coming upon the angle of attack of the main plate to as great a surface as possible in the bow of the ship. In the plan shown, this surface distribution amounts to about 269 sq. ft.

The plan or "Section E F" is proposed for the adaptation of this ram to a war-ship already built, in which the difficulty of adjusting a large single plate to the position required for the shaft is overcome by making the plate in pairs. This plan also shows heavy bars or brackets in the rear of the ram-plate for further connecting it with the ship's side, and transmitting strain from the ram to the ship.

Making Dirt Maps.

The British in Upper Burmah have found it necessary within the past two years to send several columns of troops against the uncivilized inhabitants in Burmese Shan States north and east of that country. These regions were almost as little known as the lands within the Antarctic Circle, and it was therefore a very difficult matter to move troops and adequately arrange for their food supplies. The officers in charge of these expeditions tried to get all the information they could of the country, of its mountains, rivers, fords, roads, and agricultural resources, from the natives they met, but their success was very poor. They found that by the time they had questioned the savages a few minutes they were weary and out of temper and refused to answer questions. Finally a bright idea struck one of the Englishmen. He invented a new diversion for the natives, and it worked like a charm.

Every day when camp was pitched, usually near some Shan caravansary, a space of ground was spaded up, and then the people at the inn, traders and travellers, were invited to make a relief map in the dirt of as much of the country as they knew. Capt. DUN of the British army says the natives readily caught the idea, and it was amusing to see the childish delight they took in making dirt maps of the country. They piled up the mountain ranges, excavated the valleys and rivers, stuck little sticks in the ground for forests, and indicated the regions that were well cultivated. Of course, such a map would be almost valueless unless it were made with some regard to proper proportions. So they used sticks about a foot long to represent a day's march, and on this scale they rudely fashioned their maps. Sometimes two or three hours were spent in making the map, and now and then rival cartographers would each appropriate a piece of ground and display his talents as a map maker.

The information thus obtained was very useful. The British officers were nearly every day engaged in drawing charts based upon the dirt maps in relief, and it was not often found that the native information was so far out of the way as to be valueless. It would be interesting to see whether this plan would work in Africa among the natives, of whose geographical inaccuracies the explorers are constantly complaining. Stanley is the latest aggrieved explorer, the natives having told him on his recent march to Albert Nyanza of a great lake which he fondly hoped to reach until he became convinced that it was wholly mythical.—*New York Sun.*

A CORRESPONDENT sends us the following choice specimen of an application for work from an engineer of five years' "experence," remarking, "When will the time come when 'civil engineers' will have an ordinary common school education at least?" We reproduce the letter verbatim, spelling, punctuation, and all, changing only names.

Mr. John Smith, Esq.

Dear Sir

I see by the Railway Age. That you are going to send out thouse Engineers on the extensions from Silvertan and from Ironton to Ouray Colo. I write to Assertain iff you have your parties all made up, iff not Would like to come out. I had charge of work for the Mo. Poc. R. R. the last work I done have had five years experence. Will wait your reply

Respectfully . . . .

[We congratulate the "Mo. Poc. R. R." on its assistant, the chief difficulty with whom we take to be that he is not a subscriber to this journal. Had its regular perusal been a part of his last five years' "experence" he would probably have done better in the form of his application at least. Still it is to be remembered that there have been many able men who, in their youth especially, wrote even worse than this.]

THE HALLETT'S POINT ELECTRIC LIGHT TOWER, erected by the Government in 1884 for the purpose of lighting up the Hell Gate passage, is to be pulled down. The glare of the light interferes with navigation.

Old Highway Bridge at Waterford, N. Y.

The old highway bridge which we illustrate, and which we may almost claim to have discovered, so far as engineering knowledge and record of it is concerned, is certainly the most interesting monument of early American bridge engineering in existence, which is still in fit condition for daily use, as this bridge is, and bids fair to be for some time to come. We gave some details of the structure in our issue of January 12 and February 2. We are now able to give drawings and a fuller description. The engineer of the bridge was THEODORE BURR, of Massachusetts, the inventor of the well-known and once standard Burr truss, of which this is almost the earliest as well as one of the most important examples, having been begun in 1801 and opened to public travel Dec. 3, 1804, 85 years ago, since which time it has been continuously in use.

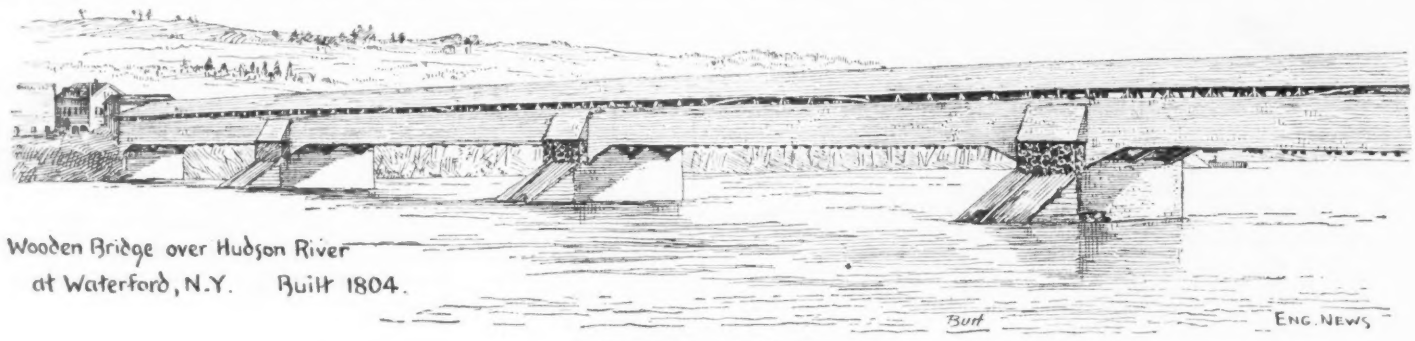


Fig. 1. General View.
Old Highway Bridge at Waterford, N. Y., over the Hudson River. THEODORE BURR, *Engineer.*

How very early it was and how bold an undertaking for its time is evident from the fact that BURR took out the very first bridge patent now on record in the U. S. Patent Office, dated April 3, 1817, 16 years after he designed this bridge. He also took out a still earlier patent, Feb. 14, 1806, beyond doubt as the immediate result of the successful completion of the great bridge which we illustrate, but all record of this patent has been lost, except its name, date and grantee, as a result of the Patent Office fire of 1836. This patent of 1806 was preceded by four others only, all granted in the single year 1797.*

The bridge illustrated is identical in its general design with all of BURR's later bridges, and with the drawing accompanying his specifications for the patent of 1817, so that there is every reason to believe that his later patent differed but little from that of 1806. His specification of 1817 is quite detailed, and is certainly minute enough in some respects, for among other things he says: "The crown-plates (upper chords) require to be raised above the floor sufficiently high to admit wagons or carriages, with any common load, to pass under the beams that lie crosswise and on top of the crown-plates." It is also specified that both the lower and upper chords, or "crown-plates," may be of two pieces, with king-posts embraced between them; or they may be single and put together with mortices. The diagonal braces are "angled," to obviate morticing. The inventor also designed placing a foot-walk outside the main bridge, and projecting the floor beams for that purpose to support it. The arch is specified as springing from the abutment from below, or from the line of the lower chord, to about the height of the upper chord, and as either single or double. The inventor, in 1817, claimed as new the arch either single or double, the angled diagonal braces, without tenon or mortice, and the footway outside the bridge. Subsequently, by a disclaimer issued in 1837, near the expiration of the patent, and of interest as the very first disclaimer of any kind on record in the patent office, Mr. BURR resigned all claim to novelty for practically everything about his patent but the arch.

The details of all these early bridge patents are given with great fulness in ENGINEERING NEWS of Oct. 28, 1882, to which we may refer without further abstract, adding only that the next bridge patent granted was of four years later date, to ITHIEL TOWN (Jan. 28, 1820) for his well-known and really meritorious plank lattice bridge, which reduces bridge building to the last degree of simplicity, and which has been and still is extensively used for country road bridges. The next patent granted (of any value) was to LEWIS WERNWAG (Dec. 22, 1829) for the remarkable design, resembling closely an arch Howe truss, and erring greatly by being deeper at the ends than at the center, but which was embodied in the famous upper Schuylkill bridge of 340 ft. clear span, which stood uninjured and in service until burned in 1838. One year later, in 1840, Lieut.-Col. S. H. LONG, U. S. Topographical Engineers patented his Long truss, resembling somewhat the Howe, and after that came the deluge HOWE'S truss was not patented until 1840 (with a second patent for 1850) and the Whipple cast-iron arch bridge, of which some thousands have probably been built, was not patented till 1841. The Schuylkill bridge was fully illustrated and described, with much original matter, in our issue of Aug. 15, 1885.

The Market Street bridge, over the river Schuylkill in Philadelphia, was commenced in September, 1801, and opened to traffic Jan. 1, 1805, so that it approaches very closely in date to the Waterford bridge. This Schuylkill bridge was erected after the plans of TIMOTHY PALMER, who has already been referred to as having taken out a patent for a bridge in 1797. The bridge was made up of three spans, two of 150 ft. each and one of 194 ft. 10 ins. The rise in the larger middle span was 12 ft., and in the smaller side spans, 10 ft. The "catenarian" arches were trussed very much after the style of the so-called Burr truss. The monument erected to commemorate the opening of this bridge, and containing a very full history of the undertaking in its inscriptions, is illustrated in ENGINEERING NEWS of Oct. 25, 1884.

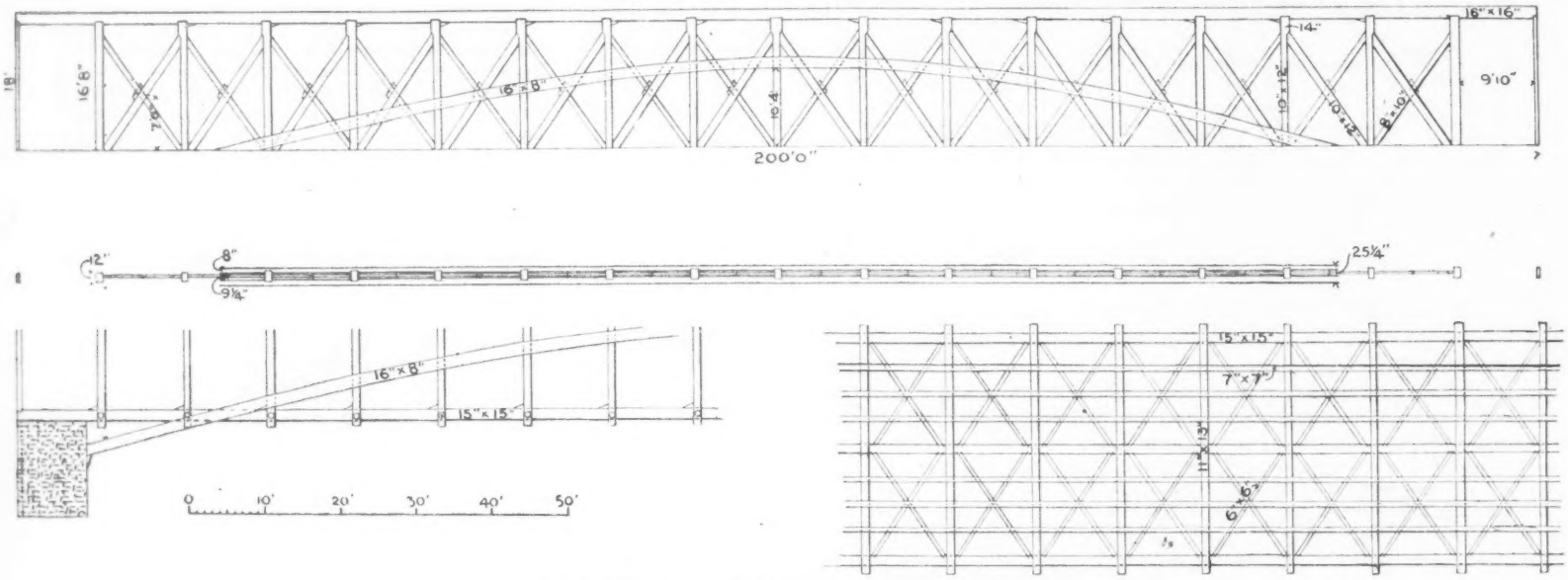


Fig. 2.—Elevation and Plan of Outer Truss and Plan of Floor.
Old Highway Bridge at Waterford, N. Y., over the Hudson River. THEODORE BURR, *Engineer.*

These records will show how very much the bridge we illustrate antedates our modern bridge era. Beginning now at the other end of the record, the wooden bridges of much span antedating this were few indeed, practically but one or two structures of one designer only, both structure and designer having been made famous by their boldness. The most famous of these structures was the Schaffhausen bridge over the Rhine, consisting of two spans of 193 and 174 ft. respectively, designed by JOHN ULRIC GRUBENMANN, a village carpenter, and shown in Fig. 5. It was built in 1757, and after being once jacked up a few years later to repair defects which developed, it stood uninjured till 1799, when it was burned by the French. It will be seen, however, to have been practically an arch and not a truss, and to be a very crude affair as a work of engineering design.

The same engineer and a brother of equal boldness built three other remarkable bridges, of 198, 200, and 240 ft. span respectively. All of these bridges were of the awkward type illustrated.

The greatest work of the GRUBENMANN brothers, and the greatest wooden span ever erected, was the

* These four patentees were CHAS. W. PEALE, Pennsylvania, January 2; CHAS. FOWLER, Pennsylvania, Feb. 24; JOHN STICKNEY, Massachusetts, June 3, and TIMOTHY PALMER, Massachusetts, Dec. 17, all of 1797. See ENG. NEWS, Oct. 21, 1882.

bridge over the Limmat in Switzerland, built 1760-65, having an arch of 390 ft. with a rise of only 43 ft., as shown in Fig. 6 herewith. This structure also is anything but an example of the most judicious use of timber, although a striking and creditable work. It stood in daily use till the end of the century, when it also was burned.

At the time the Waterford bridge was built, therefore, it was the greatest existing wooden span in the world, and the first glance at the design shows that it was not only of a strictly original type but was a much more scientifically designed structure than any which had preceded it. For aught we know, it may be the greatest wooden span which is standing to-day, so many of the short list of greater wooden spans having been burned or replaced by iron. In 1809 the bridge of Bamburg, by M. WEIBEKING, of 206 ft. span with a rise of 16 ft. 6 ins ,was built, but this was of the same crude design as all the European wooden bridges which had preceded it. The great and justly famous Susquehanna bridge, 29 spans of 200 ft. each, was not built till 1832. A bridge across the Portsmouth river, 250 ft. span, was built by SAML. BLODGET about that time.

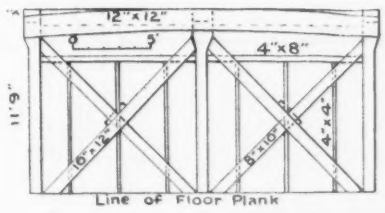


Fig. 3. Elevation of Part of Center Truss.

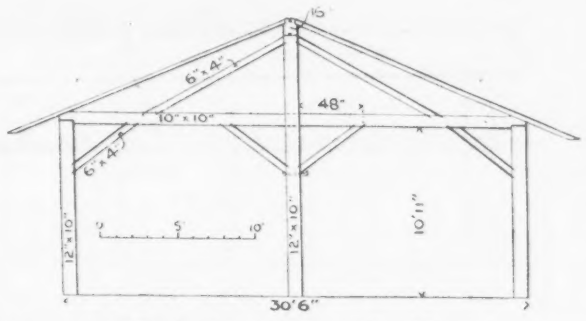


Fig. 4. Cross Section of Roof Support.

The Waterford Bridge.

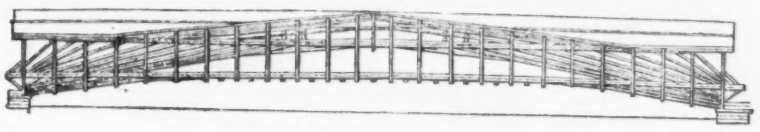
The beautiful Cascade brid ge, by Col. JULIUS W ADAMS, 275 ft. span, was not built till 1847 A Town (plank) lattice bridge of 150-ft. span was once the pride of Richmond, Va., and was a remarkable span for the kind of structure. All these have now passed away, leaving to the Waterford bridge the combined distinction of being the first well-designed wooden-truss bridge of any size ever built, the oldest of large wooden bridges still existing, and almost, if not quite, the longest wooden span still standing.

The total clear length of the bridge is 797 ft. 3 ins., in 4 spans as stated. There are three trusses to each span, all of the same dimensions. Practically all the connections, throughout, are made with wooden pins. The total width of the bridge is 30 ft. 6 ins., divided into two roadways of 10 ft. 10 ins. each, with a sidewalk to each. The height of the roof in the center is 18 ft., and the height of the roadway in the clear 11 ft. lacking one inch. The drawings are somewhat peculiar in showing nothing below the floor line on the general plans, but too much must not be expected of the drawings of a bridge over 85 years old.

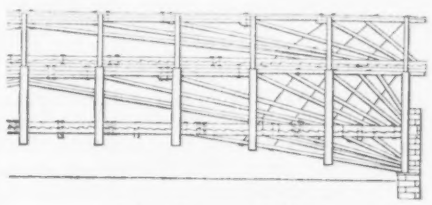
The bridge is built chiefly of hewn pine, nearly all of it cut in the immediate vicinity. The masonry was common building stone of unusually small size, laid in cement, and evidently well laid, for all the piers have stood uninjured, and the only repairs they have needed or have had has been occasional repointing. They are 18 ft. thick by 46 ft. long at the low-water line, battering back 19 ft., with a flat nose, as shown in Fig. 1. No piles were driven for foundations, although the foundations are not on rock. Some now unknown form of crib foundation was used.

The bridge was opened with no little pomp and ceremony, as was eminently proper, for it was probably a much more notable event than was realized locally. A procession was formed at Judson's Hotel, Lansingburgh, consisting of Capt. LANSING'S uniformed company of artillery, escorting Gov. LEWIS MORGAN; the State Senate and Assembly; various Masonic bodies; the stockholders and officers of the bridge company, clergy, etc. When the procession reached the center of the bridge, one gun was fired for each of the 17 States then existing. The procession then marched back to Waterford where a dinner was served.

We are indebted for most of our information, and for the use of the drawings from which our engravings have been reproduced, to Mr. H. C. ROGERS, of Lansingburgh, N. Y. The master carpenter of the structure was SAMUEL SHELLY, the mason, JAS. MCELROY. How slowly information from America used to spread through Europe (as to a great extent it does still) is curiously shown by the fact that CRESY's monumental "Cyclopædia of Civil Engineering" (published in 1847) to which we are indebted for Figs. 5 and 6 of this article, and which describes in much detail most of the structures here mentioned, with a host of less important ones of earlier and later date, not only does not refer to this Waterford bridge, but does not mention THEODORE BURR or any of his works, or give among its hundreds of engravings of wooden bridges anything of the Burr type, although by 1847 hundreds of them had been built in this country, and it was undoubtedly the most economical and technically correct type which existed prior to the Howe truss, which in 1847 was just beginning to replace other types.



Bridge over the Limmat.



Schauffnausen Bridge.

It is greatly to be hoped that the Waterford bridge may fully complete the century of life which it has already so nearly completed. If it does, a large deputation of civil engineers ought to attend the celebration which will no doubt mark the day, for it will be a really notable engineering event. The Autocrat of the Breakfast Table remarks with equal truth and humor anent the One Hoss Shay:

> Few of the things we value here
> Wake on the morn of their *hundredth year*
> Without both feeling and looking queer.

The old bridge doubtless will look somewhat queer on its hundredth anniversary, but it is its most remarkable feature that even now there is so little that is "queer" or unmechanical or antiquated about it; and it will in 1904 reflect far more credit on American engineering than will or do many more pretentious structures which are going up to-day.

GOV. LARRABEE, of Iowa, has sent circulars to shippers throughout the State asking whether present freight rates and facilities are satisfatory. Also whether State control of railways is desirable.

Modern Iron Working Plant.

At the late meeting of the English Iron and Steel Institute, Sir JAMES KITSON, the president of the Institute, in his opening address referred to the recent advances made in plant for working iron. He said that 50 years ago his father secured with difficulty from the Low Moor Works a fire-box plate of the then unprecedented weight of 5 cwt.; while now Cammell & Co. have rolled a plate weighing 65 tons. Twenty-five years ago an output of 250 tons of plate was good work for one mill; now 1,000 tons per week is turned out steadily. The Barrow Steel Co. by using five rollers to transport the ingots to the cogging mill, and thence to the receiving bench, could roll 5,000 tons of rails per week if continuously fed with ingots.

A large shearing machine in the works of J. Buckton & Co., at Leeds, with a blade 10 ft. 6 in. long, can cut cold a steel plate 2 ins. thick. It will cut a plate 7 ft. wide in two at one stroke, and a similar machine will cut blooms 30 ins. wide and 11 ins. thick, cutting regularly 2,000 tons of measured slabs per week. A testing machine made for the Malta dockyard by Messrs. Buckton will break an iron cable 3½ ins. in diameter, and will test up to proof load 4½-in. diameter iron. It will crush, twist, bend, or shear specimens of steel up to 3-in. diameter, and will take a length of 80 ft. between the shackles, and the hydraulic ram has a stroke of 7 ft.

The steam hammer is in more senses than one the most striking of all the tools of the engineer. The 100-ton steam hammer at Creusôt has a cylinder of about 75 in. diameter and a stroke of 16 ft. 4.8 in. and the anvil block weighs 750 tons. The 50-ton hammer at Essen was one of the first of the big hammers and was erected in 1861; its anvil-block weighs 1,100 tons, and the excess over the French block is wise. In giving a list of the heaviest steam hammers in Europe, the president credited England with one 30 and one 35-ton hammer at Elswick and Woolwich; KRUPP had one 50-ton hammer and Russia had two 50-ton hammers; but France has four 20, three 25, one 35, two 40, one 50, one 80 and two 100-tons hammers, all of them, as well as the others, being double-acting. The overwhelming French array of big hammers is ascribed to Government encouragement to manufacturers to undertake the responsibility and heavy outlay by a continuous order for heavy guns.

But the president believed that the days of heavy hammers, whose blows disturb a whole district, were numbered, and that they would be supplanted by the silent, slow-working, but irresistible hydraulic press. The 4,000-ton press of John Brown & Co. would reduce a 34-ton ingot, originally 52 ins. in top and 46 ins. in bottom diameter, to a 28-ft. gun tube 29 ins. in diameter in four heats. Cammell & Co. have a 5,000-ton press. The work of the hammer is abrupt, is expended in a very short space of time, and consequently forces the metal into shape suddenly, while the force of the blow is absorbed to a great extent upon the surface of the forging. As showing the contrast between this method and the slow flow of hydraulic pressure, the speaker exhibited two short pieces of round steel, 5 or 6 ins. in diameter. The hammered piece had hollow ends, showing a tendency to "pipe," while the pressed example had convex ends.

KANSAS RAILWAY RATES were hardly high enough last year to enable the companies to pay their operating expenses. What they will fall to this year, if the precedent established by the State Railway Commission in the Wichita case is followed, remains to be seen. The wholesale dealers of the ambitious city of Wichita appealed to the State Commissioners to oblige the railways to grant them reduced or "jobbing rates" against Missouri river points up to a line 75 miles east of Wichita. The petition has been granted in spite of the opposition of the railway managers, and now, as was expected, the jobbers of Arkansas City, Winfield, Ft. Scott, and about all the other numerous and ambitious trade centers in the State are preparing petitions to secure similar reductions, which the commission cannot consistently refuse to grant. Kansas farmers demand low rates in years of poor crops on account of hard times, and low rates in years of good crops on account of low prices. Between them and the jobbers the railways of the State have a hard lot.

The Decauvil'e Railway at the Paris Exposition.

A very complete description of the justly famous Decauville system of portable railways is contained in the Exposition number of *Engineering*, and from it we use the illustrations and condense the text as follows:

The Decauville exhibit includes a railway fully equipped with stations, etc., entirely encircling the present exhibition grounds. The gradients are very easy, the maximum being 1 in 40 about 300 ft. long and the minimum curve has a radius of 65 ft. 7 ins. The line is double track throughout with sidings at stations, and the gauge is 2 ft. with 6 ft. between inside rails. The tariff is fixed at 25 centimes, or 5 cts., independent of distance, and the speed is limited to about 10 miles per hour and 2 miles at level crossings. The length of any train is not to exceed 165 ft.

The entire system is that of M. DECAUVILLE, Ainé, of Petit-Bourg, who has supplied all the material. Fig. 1 shows the permanent way. The rails weigh 19 lbs. per yard and are made of steel and riveted to the stamped steel cross-ties. The latter are 3 ft., 7 ins. long, and 5.51 ins. wide; the finished depth is 1.14 in. and the thickness is ¼-in. The ties are spaced 25.16 ins. apart between centers, and the rails are riveted to them by three rivets. The rail itself

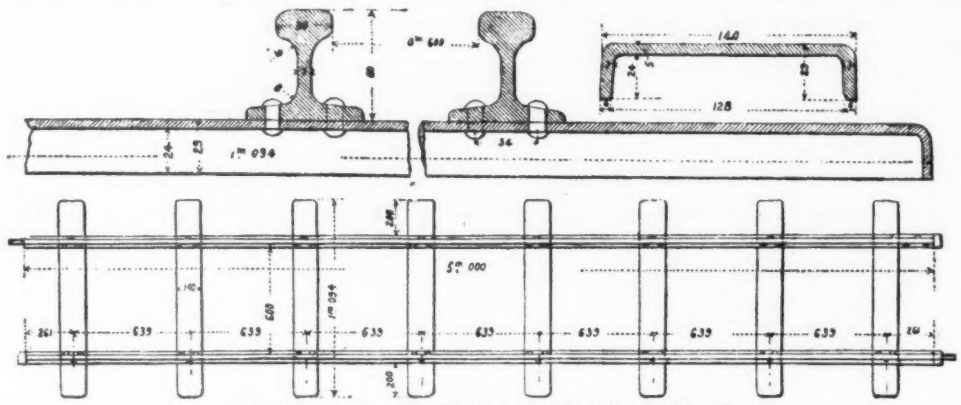


Fig. 1. Decauville Railway: Details of Track.

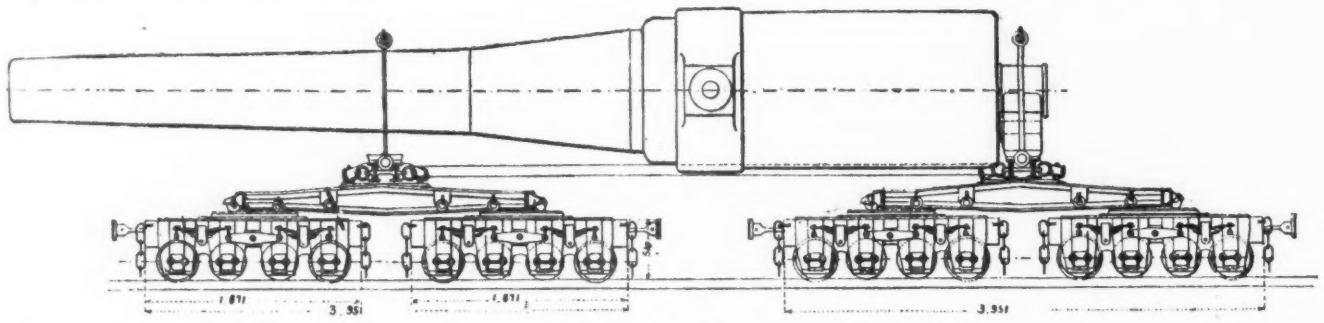


Fig. 1a. 48-Ton Trucks, Decauville Railway.

is 2.36 ins. high and 2.52 ins. wide on the flange. The length of one section of the permanent way, as delivered riveted-up from the works at Petit-Bourg, is 16 ft. 4.85 ins. The joints are made by fish-plates

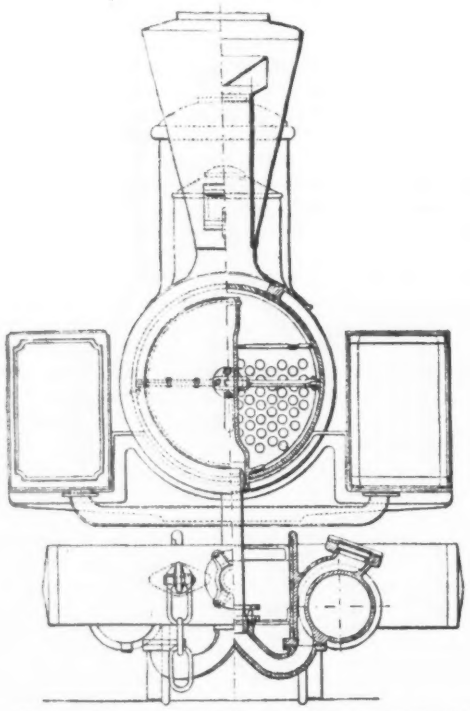


Fig. 3. Decauville Railway: Compound Double Truck Locomotive.

with the end ties spaced only about one foot apart. This permanent way is designed to carry a service load of 3 tons on each axle. The same Fig. 1 shows this system as used by the French War Office for transporting 48-ton guns on sixteen axles. In laying the line the ties are well embedded in ballast.

The traffic on the Exposition line is worked by 15 locomotives and 100 carriages. This is considered sufficient to run trains at 10-minute intervals, or 180 trains per day. The type of locomotive employed is shown in Fig. 2. It is an eight-wheeled compound articulated engine on the Mallet system, with the following principal dimensions:

Gauge	23.62 ins.
Minimum radius of curve	65.00 ft.
Angle of bogie truck with axis of engine on curves of 65 ft. radius	6°
Maximum gradient	8 per cent.
Fire-grate surfaces	5.30 sq. ft.
Heating surface—fire-box	24.75 "
" " —tubes	215.28 "
Total heating surface	240.03 sq. ft.
Working steam pressure	170 lbs per sq. in.
Diameter of wheels	23.62 ins.
Length of rigid wheel base	33.47 "
Distance between wheels of rigid and bogie trucks	3 ft. 7.31 ins.
Extreme distance between axles	9 ft. 2.24 ins.
Diameter of high-pressure cylinders	7.36 ins.
" low " "	11.02 "
Length of stroke	10.23 "
Capacity of water-tanks	312 galls.
" coal bunkers	18 cu. ft.
Height of center of boiler above rails	4 ft. 3.2 ins.
Width of engine over all	6 ft. 2.8 ins.
Weight of engine empty	9.3 tons.
" " in running order	11.3 "
Height from rails to top of chimney	9 ft. 3.46 ins.
Total length over all	17 " 7.81 "

The Mallet system is well known and has been often described, and the illustrations clearly show the method of articulating the bogie truck to the main train and the sliding and radial arrangement of the steam connections between the high and low-pressure cylinders. The end section, Fig. 3, shows the connection between the exhaust and the blast-pipe. [An engine of this type was described and illustrated in ENGINEERING NEWS, Sept. 1, 1888.—ED. ENG. NEWS.]

Fig. 4 shows the standard passenger cars. They are 28 ft. 6.5 ins. long, end to end of frame, 5 ft. 7 ins. wide outside of body, and are carried on two four-wheeled, trucks spaced 22 ft. 7.6 ins. apart on centers. The under frames are made of iron and consist of two latticed girders of the length before given and 5 ft. 6.9 ins. apart. These girders are 11.8 ins. deep and have top and bottom angle-irons 2.76 × 2.76 × 3.5 ins., with stiffening webs: to the latter are riveted the lattice bars 1.58 × .31 ins. The ends of the girders are connected by curved cross-beams of similar section, and at intervals of 4 ft. channel irons, 1.97 × .98 × 20 ins., are secured transversely to the under side of the girder; immediately above these, cross connecting angle-irons join the tops of the girders. A central stiffening beam extends between these cross-frames, excepting near the end, where the trucks are placed, and the floor of the car is secured to the top angle-irons of the longitudinal girders. Each car carries seated 48 persons besides standing room for 8 more. The width over the continuous side foot-board is 6 ft. 8 ins. and the clear roadway from floor to roof of car is 6 ft. 5.8 ins.

The wheels in the truck are 17.72 ins. in diameter and are made of steel, and the truck-frame is iron. The pin connection with the body of the car is shown in Fig. 4. The *Société Decauville Aîné*, at Petit-Bourg, exhibited its system for the first time at the Paris Exposition of 1878, when the total plant sold by the firm the previous year amounted to only $100,000. During the current year plant to the value of $2,000,000 has been delivered.

Massachusetts Water-Power Practice.

(Concluded from Page 477.)

LOWELL.

The history connected with the development of the water supply of Lowell is an extremely interesting one. The Pawtucket canal, one of the principal feeders of the Lowell system, was opened in 1796 for navigation around the Pawtucket Falls. It is about 1½ miles across the bend to the Concord river just above its confluence with the Merrimac. One of the strong incentives for building the canal was the fact that logs from New Hampshire had to be hauled across this bend to escape the falls. In 1822, those far-sighted and energetic men, LOWELL, APPLETON, JACKSON, and BOOT, obtained control of the water-power, and proceeded to develop it for manufacturing purposes. The first wheel was started in the Merrimac mill in 1825.

As we examine the ground plan of the present works, we notice a complexity of lines which seem to lack simplicity in design. The canals have, in fact, been built at various periods, as exigencies have arisen, and they seem to run around in every possible direction. Even the dam itself, a structure which we are accustomed to look upon as either straight or curved in plan, seems overcome with the general disorder, and wanders about at all conceivable angles, in some places parallel with the current. Notwithstanding this, there has been a most intelligent supervising power in it all, and as we study into the details we find there has been good ground for every step of growth. However, any one who desires to carry the whole of the Lowell plan in his head, will have to return to the study of the subject again and again. It will be noticed that, unlike Lawrence, the Lowell works are all situated on one side of the river only.

The present dam is of masonry. The portion built in 1887 was laid of dry ashlar, and as some of the stretchers afterwards moved out of place, the new dam was laid dry, and grouted, course by course, with pure Portland cement. By this method of construction, even if the cement should fail, there could be no settlement in the mass. The length is 1,093 ft. and the height varies from 2 to 16 ft., ex-

cepting in one deep hole, where the foundation was 38 ft. below the crest.

The dam backs up the water in the river a distance of 18 miles, or about twice as far as does the Lawrence dam, and thus provides an immense reservoir for the storage of the flow of the river during the night, at which time no water is used in the mills. The present dam was built in 1875-6 by Mr. JAS. B. FRANCIS, whose fame as a hydraulic engineer extends into every land where the science of hydraulics has a foothold. Mr. FRANCIS has designed nearly all of the Lowell works. The great North canal will long remain a monument to his skill. The Pawtucket canal was the old one, running across the bend of the Merrimac and uniting with the Concord river. The Northern canal, which is a beautiful piece of engineering construction, follows closely the bank of the main river for a portion of its length. A great wall separates the canal from the river.

The head gates to both canals are operated by water-power, but differently applied. The Northern canal is fed through 10 gates, each 8 ft. by 15 ft. They are operated from a line of shafting driven by a turbine wheel.

In the gate-house at the head of the Pawtucket canal there are 5 gates, each 9 ft. by 10 ft. The spindles of these gates are connected with a piston in a cylinder, and the gates are raised and lowered by pressure from a water main.

Over one of the locks in the Pawtucket canal is a high building, in which hangs an enormous wooden gate suspended from a truss by an iron link. To lower the gate, the huge link must be cut through with cold chisels. The history of this great gate is interesting. Mr. FRANCIS, fearing that a freshet might some day arrive which would overflow the canal and flood the city, constructed this gate in such a manner that the link could be chipped through, the gate dropped, and the city saved. There were many men who wagged their heads knowingly at this seemingly unnecessary precaution. Some even went so far as to call it "Francis' Folly." Strange to say, only a short time after its completion, the disastrous freshet came, the giant gate was cut loose, and the city protected from inundation. It would be invidious to say that some men are born lucky, but I have heard the remark made by aspiring engineers when looking at this gate.

The Northern canal is 100 ft. wide and about 18 ft. deep. It cost $500,000 and carries twice as much water as the Pawtucket canal. The river wall is 36 ft. in height. It is provided with waste gates and overflow, a short distance below the dam. There are six smaller canals, forming a network in the city and distributing the water brought by the two great feeders to the mills, in all about 5 miles of canal. They are of rectangular section and about 10 ft. in depth. The Moody St. feeder is a covered structure of three arches, each of 10-ft. span. Its length is about ¼ mile, and it was built to connect the Merrimac and Western canals. Its cost was $86,000.

The total fall at Lowell is 33 ft., mostly distributed in two levels of 14 ft. and 19 ft. respectively. About one-sixth of the water is used on the whole fall and the remainder on the two levels just mentioned. A mill power is defined as the right to draw 25 cu. ft. per second on a 30-ft. fall for 15 hours. The power is all owned by the proprietors of the locks and canals on Merrimac river, a corporation which in turn is owned and controlled by the mills using the power under perpetual leases. The price of water-power is consequently very low, something like $3.53 per H. P. per annum. There are 77 turbine wheels in use, of which 50 are Boyden, 26 Swain, and 1 Humphrey. One of the Boyden wheels is 132 ins. in diameter.

The method of measuring the water supplied to the mills varies somewhat from that in use at Lawrence or Holyoke. It will be readily understood that circumstances and construction have everything to do with such methods, and that what answers well in one place will not always be applicable in another. There are no piezometric observations as at Lawrence, but careful flume measurements made in the canals take their place. A section of canal is carefully prepared for this purpose, and the velocities are taken by means of long tin tubes, weighted, which are floated between known points and their direction and time taken. At Lowell there is no room to measure the water running in the tail races, as the mills are built directly over the river.

The velocity in the canals is very considerable. I have often noticed the water running as fast as 3.5 ft. per second. It is always interesting to an hydraulic engineer to form some rough idea of the quantity of water flowing in any water supply system, although in the absence of uniform standards for estimating large quantities of water, it is not always possible to convey to others a definite idea by the same unit. On one visit I found the canals carrying over 5,000 cu. ft. per second, which would practically empty Lake Cochituate in one day. At this same time they were using rather more than this at Holyoke, 7,000 cu. ft. per second, counting the day and night run, 4,000 cu. ft. per second during the day and 3,000 during the night. One of the perfections of the Lowell system is that the water-power is all utilized, practically without waste.

The Merrimac river, which turns the wheels of Lawrence, Lowell, and other large manufacturing towns, is said to be the most noted water-power river in the world; for nearly its whole course of 100 miles, from its sources to the sea, its power is utilized. It has been estimated that there are 100 miles of reservoir surface at its upper waters, which afford unsurpassed reservoirs for equalizing the supply. These make the river remarkably steady in flow. Again, the fall of the stream, while only averaging 2½ ft. to the mile, is concentrated at a few points and at rocky falls, which enables the power to be easily developed. This same cause contributes to prevent those sudden and extraordinary freshets which visit southern and western rivers. The area of the water-shed above the dam is about 4,000 sq. miles.*

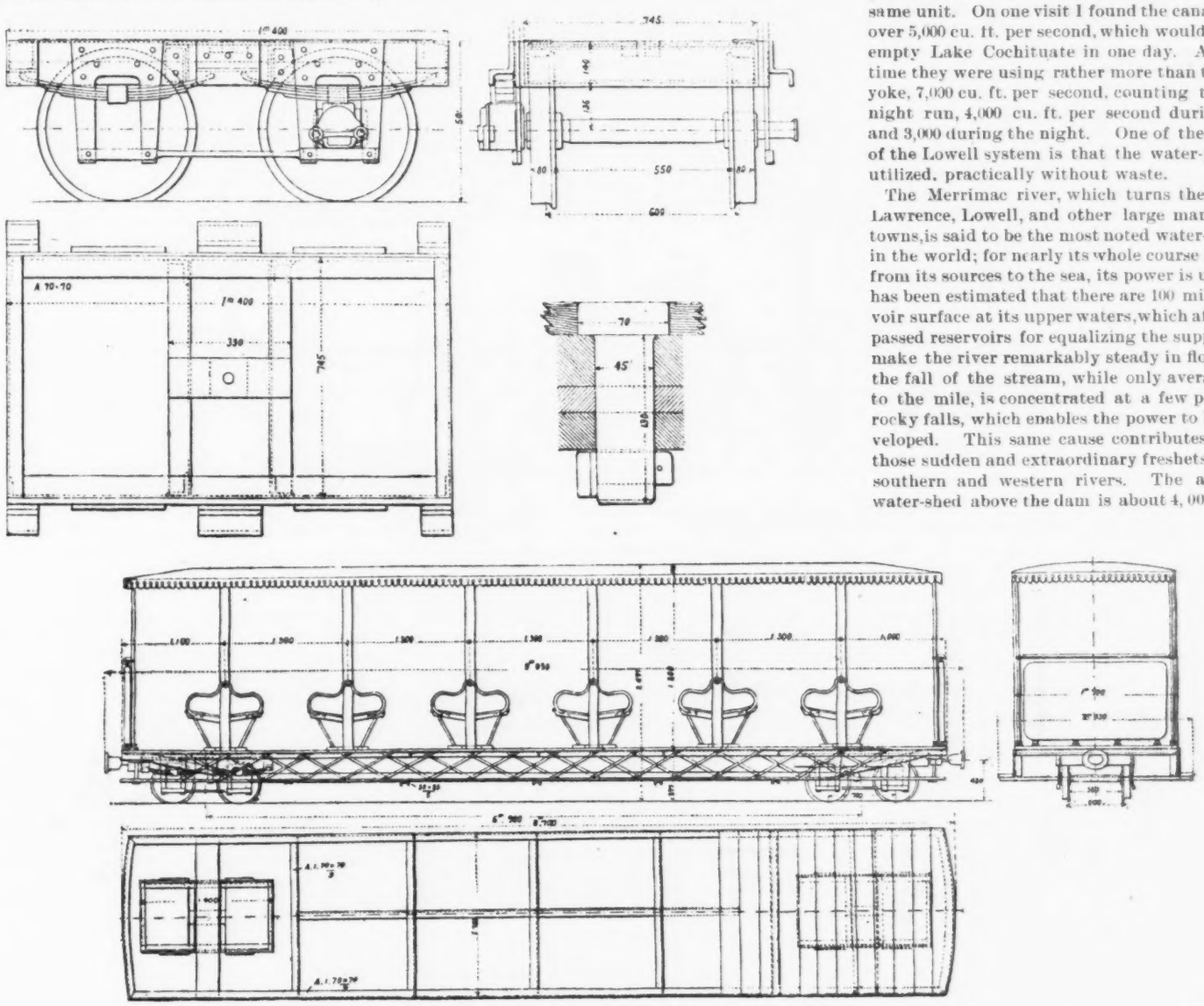


Fig. 4. Decauville Railway: Details of Standard Passenger Car.

Lowell has been called the incarnation of a hive of industry. There are about $14,500,000 invested in its ten largest corporations. These are the Merrimac, Hamilton, Appleton, Lowell, Middlesex, Tremont & Suffolk, Lawrence, Boot, and Massachusetts Mills, and the Lowell machine shop and Lowell bleachery. The number of spindles is 846,000, employés 18,000, and nearly 5,000,000 yds. of cotton cloth are woven weekly. Besides these ten large companies, there are numerous smaller corporations engaged in the manufacture of all kinds of articles. In addition to the water-power employed, 7 of the above mills have 140 steam engines of 18,150 total H. P., and they use 57,844 tons of coal yearly, while their weekly pay-roll amounts to $81,038. In the Lowell machine shop, a mill of 40,000

*Any one desiring to go farther into the details connected with the Lawrence and Lowell powers will find able and interesting articles in the tenth census from the pen of Prof. SWAIN and one on Holyoke by Prof. PORTER.

spindles can be fully supplied with machinery in three months' time.

HOLYOKE.

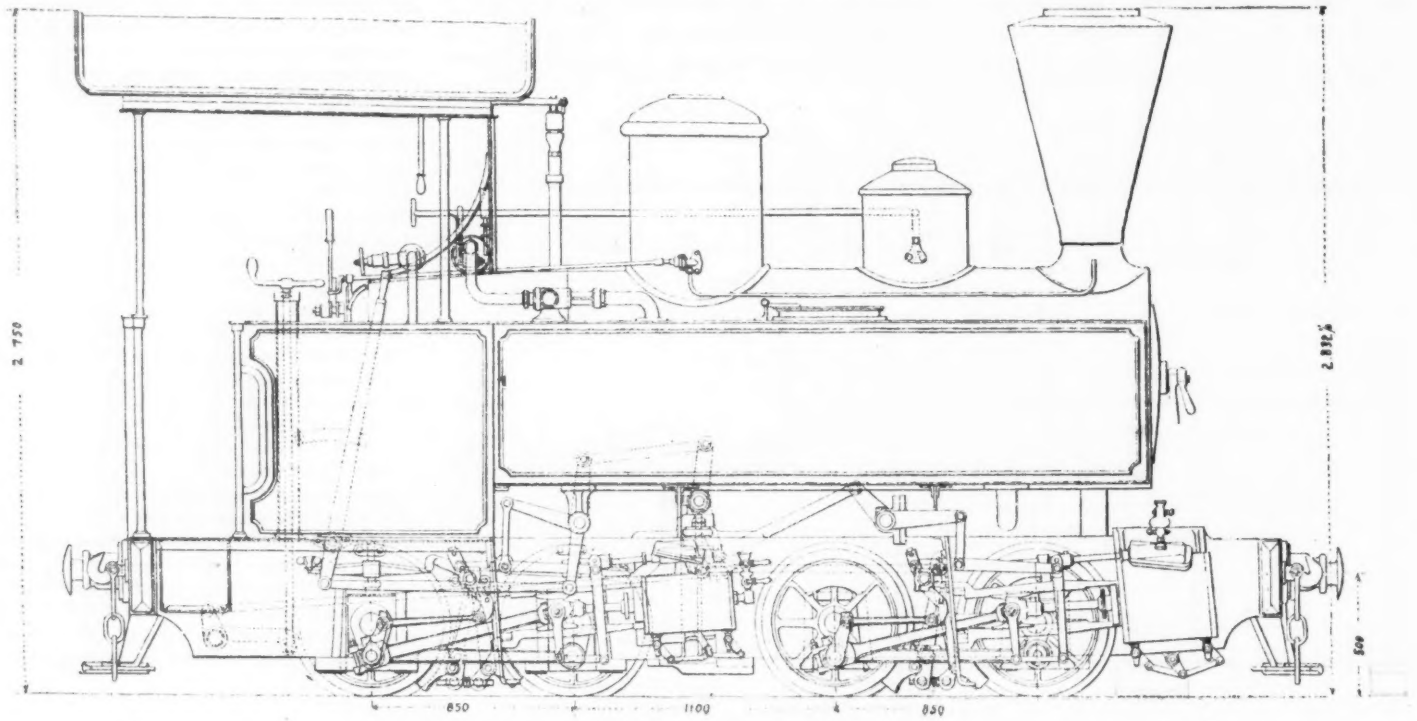
Holyoke boasts the largest water-power of any of the great manufacturing centers of Massachusetts. The whole of the Connecticut river, with its 8,144 sq. miles of water-shed, is captured and turned into mill powers. The capital used is about $15,000,000, and 12,000 hands are required. The water-power developed during the day is about 15,000 H. P., and in the night about 8,000. The visitor cannot but be impressed with the excellent design of the works, built in 1849; particularly their systematic and comprehensive plan. The canals were so placed that very little alteration has been necessary as the power has been developed.

The bulkhead to the canal is 40 ft. wide and is pierced for 12 large gates, each 8 ft. by 15 ft., and two smaller openings. These are covered by a brick building which forms the head gate-house. The openings are controlled by massive wooden gates, which are operated by a shaft and gearing worked by a turbine at the dam end of the gate-house.

The waste weir in the canal just below the gate-house is an important piece of masonry, pierced at its lowest level for gates to empty the canal, and surmounted by a long overflow and flash boards in the usual manner. The total fall at Holyoke is 60 ft., to which the dam contributes 35 ft. and the rapids below the dam 25 ft.,—a splendid power when we consider the large volume of water flowing in

The first canal is more than a mile in length; the second is parallel, and but a short distance from the first; but the third canal is at a considerable distance from the others, with a large part of the city between. The course of the third canal is parallel with the river. A waste weir 80 ft. in length, at the end of the second canal, discharges surplus water into the third, and there is still another leading from the third canal into the river.

There are some points in which Holyoke differs materially from Lowell and Lawrence. There is comparatively little steam used, as the river with its large falls is sufficient to do nearly all the work required. A large number of the mills are paper mills, running night and day from Sunday night to Saturday night, six days out of seven. Under these



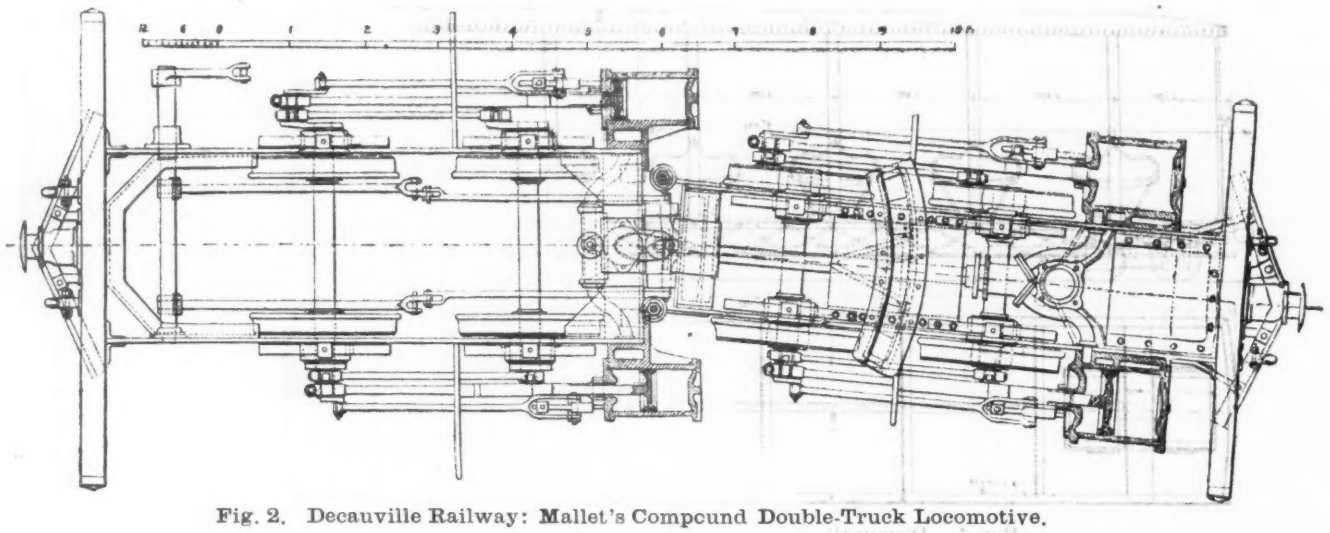


Fig. 2. Decauville Railway: Mallet's Compound Double-Truck Locomotive.

A glance at the historic side of the Holyoke works gives many interesting engineering lessons, such as the carrying away of the first dam and the many defects in the present one. This matter has already been ably presented by Mr. CLEMENS HERSCHEL, the engineer of the Holyoke Water-Power Co., in a paper describing the dam, the danger from decay and the steps taken for its preservation. The crib work, of which the dam is constructed, was filled with a grouting of gravel ingeniously applied. The height of the structure is 35 ft., length, 1,017 ft., and 13 ft. of water have passed over its crest. The bottom course of timbers was bolted to the ledge on which it rests. An apron was an after-thought, and only added when it was found that the force of the water was wearing a great hole in the rock. This apron is 50 ft. wide at the base and cost $263,000. In connection with the dam there are the abutments, the bulkhead for the canal, the lock walls, waste weirs, and gate-house.

the Connecticut. There are three levels in the canals. The first has a fall of 20 ft.; the second, 12.5 ft.; the third, from which the water escapes again to the river, 27 ft. The first canal is rectangular in section. It is 150 ft. wide at the upper end, and there is a gradual reduction in width throughout the system to 100 ft. in the third canal. The general depth of the water is 8 to 10 ft.

The canals have been well designed for control by a small force. A single man, stationed at the junction of the first and second level, does the principal work. This point is but a few steps below the gate-house, so that the same man can work those gates also. The overflow from the second canal into the river is within convenient reach of the same gate-keeper. The overflow from the upper level is 40 ft. in length. There are also gates in the bulkhead. By means of these arrangements, water can be fed to the second canal independently of the discharge from the mills on the higher level.

conditions of manufacturing, the large flow of the stream is an important factor in the development of the power. At Lowell, for instance, there is the run of 10 hours and the rest of 14, during which the large mill-pond above the dam can fill up. At Holyoke a mill-pond of great capacity is needless.

The paper industry at Holyoke is the largest in the United States. There were, in 1883, 23 companies engaged in this branch of manufacture, employing 4,000 hands, and turning out a finished production of from 150 to 160 tons per day. The quality and variety of the paper are astonishing. The fine grades of writing paper are said to rival any in the world. Besides the paper mills, there are many other extensive manufacturing establishments, but the mills strike the visitor as older and not as fine as those at Lowell and Lawrence.

The method of measuring the water at Holyoke is somewhat different from that pursued on the Merrimac. The measurements are based entirely

on the observations on the water-wheels, which are made to act as their own meters without other check. Before the wheels are set, they are put into the testing flume and their duty carefully measured for several openings of speed gate and under different heads. From these tests, curves are plotted for the various conditions of service. This testing of water-wheels is a specialty at Holyoke, and nowhere else in the world are there the same facilities for doing this work.

A flume designed for the purpose by MR. HERSCHEL has been built by the Holyoke Water Power Co. at an expense of about $30,000. When it is desired to test a wheel at any other place than Holyoke, a special arrangement of apparatus must be improvised, and such a test may easily cost $2,500. The Holyoke Water Power Co. is ready to do this same work at any time for $100 to $150; consequently wheels from all parts of the country are sent to them to be tested. The flume consists essentially of a large masonry chamber to which the water is brought by an iron trunk from one of the canals. The flume is built so as to facilitate the easy setting up of a wheel, the application of the Prony brakes, and the measurement of the water over a 20-ft. weir having a capacity of 200 cu. ft. per second. Over the whole is a substantial building containing repair shops and offices. Wheels are usually tested for five or six openings of the speed gate and at five or six different velocities of revolution at each opening, or about 30 experiments in all. The wheels to be tested are swung into the building by a traveling windlass and lowered into the wheel pit. The power is weighed by a Prony brake, consisting of a cast-iron pulley surrounded by a hollow brass bands through which a stream of water is allowed to circulate. A bent lever and weights hold the band and pulley in place. There are five sizes of pulleys and bands. To enable the observer at the brake wheel, the one at the head gauge, and the one at the weir to take simultaneous observations at intervals of one minute, an electric clock is rigged to ring three bells at the same instant. The masonry of the testing flume is so perfectly laid that under 20 ft. head it is scarcely damp on the inside.

Of the 134 wheels at Holyoke, 74 are Hercules, 33 Boyden, 9 American, 8 Tyler, etc. The Hercules, which is so largely used at Holyoke and elsewhere, is a high-duty wheel, economical, ready-made, and can be easily set and taken out. By means of its ample water-power, Holyoke has grown from a mere village to a city of 30,000 inhabitants. The Water-Power Co., whose franchise was purchased of a bankrupt corporation in 1859 for a small sum, is now a wealthy corporation whose stock sells at about 250 and whose dividends are about 15 per cent. In addition to disposing of water to the mills, the company has built several mills which are leased for water-power purposes. A mill power at Holyoke has the right to draw 38 cu. ft. per second on 20 ft. fall for 16 hours, or 86.3 theoretical H. P. If a turbine gives 80 p. c. duty, a mill power would yield 69 H. P.

The Purification of Water by the Magnetic Spongy Carbon Method.

Lately, under the auspices of the Liverpool Engineering Society, Mr. C. H. BELOE, M. Inst. C. E., read to a pretty numerous assemblage of members, under the chairmanship of Mr. C. H. DARBISHIRE, A. M. Inst. C. E., an interesting paper on "The Purification of Water and Sewage by the Magnetic Spongy Carbon Process." Good water and plenty of it, he said, was one of the first essentials for health in populous places. The difficulty of obtaining such was often very great, but rarely if ever insurmountable. Of equal importance was the disposal of liquid sewage, and he proposed to show how both could be attained economically and efficiently. A great natural cause of purification of water, which would otherwise be unfit for human consumption, was the aeration effected by passing over rocks, waterfalls, etc., and destroying the foul matter held in solution. By this means rivers that received sewage of towns became more or less fit for human consumption after having passed for some distance down their course. In the majority of cases, subsidence and mechanical filtration were the only artificial means adopted for the purification of water on a large scale, and it was essentially a mechanical or straining process, which could only remove the matter in suspension in the water, and had hardly any appreciable effect on the matter in solution, which was invariably the more deleterious substance of the two. In both large and small filters the amount of matter in solution was generally increased by passing the water through the filter, for unless the ordinary filtering material was frequently cleansed, the decomposed substances arrested in the pores of the filter were absorbed in the water. No matter what material was used as the filtering medium, considerable economy in working could be effected by employing large subsidence tanks, if the water to be purified contained much matter in suspension. The difficulties attending the use of all previously known filtering media had led to the discovery of magnetic spongy carbon, commercially called "polarite." It was a pure and absolutely insoluble mineral substance, specially manufactured for the filtration of water, fluids, and gas. This mineral having been carefully examined and tested by Sir HENRY ROSCOE, M. P., he had reported that its complete insolubility and freedom from rust constituted its claim to be considered a valuable filtering material. Containing no poisonous metal, it was very hard, porous, and absorbtive. It extracted iron and lead from water, and destroyed organic matter in solution. There were several methods of applying this material to the purification of water. Water supply could be purified on a large scale by passing it through a filter constructed in a manner similar to the ordinary sand filters, with the addition of a layer of polarite at least 6 ins. thick, mixed with an equal quantity of sand. From 500 to 1,000 galls. per sq. yd. could be obtained from it in 24 hours this being a higher rate than by the ordinary filter. Dealing with the subject of sewage purification, Mr. BELOE said that the practice in vogue in the majority of towns was first to clarify the sewage by precipitation, and afterwards pass to the effluent water on to land or through specially prepared filter beds. After describing various processes adopted in the precipitation of sewage matter, he referred to the "international process," which was in use in various places, and which had given the greatest satisfaction. It was a magnetic precipitant and deodorant called ferozone, which was rich in ferrous iron, and which also contained alum, calcium, sulphate magnesia, and rustless magnetic oxide of iron in a very spongy and absorbtive condition. Its cost for sewage filtering would be about 14s per sq. yd. or £4 = per ton. Sewage, the lecturer remarked, was not the mine of wealth which it was at one time supposed to be, but a noxious body that must be got rid of by the simplest and most effectual means possible.

The Trinidad Pitch Lake.

The most interesting place in Trinidad, says a correspondent of the Detroit *Tribune*, is the famous pitch lake from which comes the world's supply of asphaltum. It covers 99 acres and contains millions of tons of pitch, which never grows less in amount, for that taken out during the day is renewed by nature every night. In the neighborhood of this Stygian pool the air is heavy with the most sickening odors, and the surrounding country is covered with its overflow, so that the earth is as hard as the pavements of Washington; but neither the steam and fumes that arise from the pitch roasting in the sun, nor the asphaltum in the soil, seems to injure vegetation; for flowers and fruit actually grow and flourish there, and pineapples are also brought to the greatest perfection. The lake is a floating mass of asphaltum, seamed by narrow channels of clear water, with a few straggling islands covered with thin, low shrubs. At the center, the fountain of all the foulness, the pitch is at boiling heat, and covered with yellow and white sulphurous foam, upon which float innumerable bubbles filled with loathsome gas. The old proverb that one may not touch pitch without being defiled does not hold good here, for this substance will not stick to the hands, and you can take up a chunk and mould it like clay without soiling your fingers. The supply for shipment is chopped from the surface, where it has been hardened and dried by the evaporation of the moisture; but, like ice on the ponds of the frozen zones, the quantity cut away during the day is always replaced during the night, for some action of nature keeps forcing the substance out of the earth.

The pitch lake is a mystery which scientists have discussed for many years. Sir WALTER RALEIGH wrote the first account of it in 1595, when he landed there on his voyage in search of the Eldorado and the land of the Amazons. HUMBOLDT gave a good deal of study to the phenomenon, and declared that the pitch lake is "a constantly aggregating mass formed from the cosmical gaseous fluid," which seems to settle it.

A few miles away is a mud volcano on the mountain of San Fernando, called "Salse"—a circular pile of mud some two or three acres in extent, bottomless and hot, and evidently occupying some old crater. The mud is heaped up in piles like monstrous ant-hills, at the top of which are holes through which the moist stuff oozes, and sometimes flames are said to appear. The contents of this basin are really impure asphaltum; for the odor is the same as that about the pitch lake, and the component parts are similar, but the greater quantity of earth in the mixture makes it worthless for economical purposes.

THE ASSOCIATED FACTORY MUTUAL INSURANCE COMPANIES have issued another of their very valuable circulars for the prevention of fire dangers, the care and technical skill with which this work is done being one of the most encouraging signs of the times. If equal care were used by our general insurance companies the fire losses in this country would not be so disgracefully high. This circular is chiefly confined to enforcing by illustrations the necessity of protecting *all* parts of buildings by automatic sprinklers if any are so protected. They say in large type:

The only conclusion to be derived from these facts is this:

Wherever a sprinkler can be placed over each hundred square feet of floor surface within the building to be protected, a sprinkler should be put, if the purpose of the owner or representative of the risk is complete protection and immunity from interruption in the conduct of his work.

They have also an emphatic word to say about the dangers of crude petroleum as a fuel, as follows:

On testing this crude oil it was found to consist in very considerable part of extremely volatile matter, giving off heavy explosive and combustible vapors, at less than the freezing point, the advantage claimed being that the crude oil would flow more freely in cold weather than the reduced oil, which may or may not be true. Such an advantage does not compensate for the probable danger which may or mus ensue from the introduction of a liquid which will give off 15 to 20 per cent. of its weight in extremely dangerous heavy vapors at or below 60 to 65° Fahr."

"These "extremely dangerous heavy vapors" are the vapors of gasoline, on the use of which for car lighting we have lately had something to say.

GEO. WESTINGHOUSE, Jr., who is still in his 43d year, having been born in Central Bridge, N. Y., Oct. 6, 1846, showed early the remarkable mechanical genius which has made him, perhaps, the greatest living mechanical engineer, as the following anecdote amusingly illustrates:

His father owned and operated large works at Schenectady, N. Y., for the manufacture of agricultural implements, and showed his good sense by giving his boys, as a part of their education, practical instruction in mechanics.

George, however, was very fond of playing ball, and was frequently "found absent." These absences led to interviews; and at last it was decided that his work should be arranged on the piece system instead of on the time system. His task was thenceforth to consist of a given amount of work each day, which he might expedite as much as he pleased, and, after it was done, he was at liberty to repair to the ball grounds. The opportunity was not neglected. Without any previous knowledge of the now well-known disc method of cutting metals, he experimented, and soon discovered that, with a circular disc of soft sheet iron, on the highest speed of his lathe, he could split a file. He quickly utilized this method of completing his daily task, and repaired so early each day to the ball grounds, that his father at first feared a miscount had occurred. On watching him at work, however, he soon saw, with his own eyes, how the remarkable feat was accomplished.

Mr. WESTINGHOUSE'S attention was first turned to the invention of air brakes by seeing a crude experiment with steam on the New York Central Railroad, and by a familiarity with railway needs and methods gained when introducing a reversible steel railway frog.

GREASING CABLES, as a means of reducing renewal expenses in cable-roads, does not seem to work well in Chicago. The cable may last longer; but as the grips won't work, the would-be passengers walk, and dividends are reduced accordingly.

THE BOSTON ELEVATED RAILWAY BILL was defeated in the Massachusetts Senate on May 15 by a vote of 20 to 15.

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

Engineers' Club, Philadelphia, Pa.—Regular meeting, June 1. Secy., Howard Murpoy, 1122 Girard St.

Engineers' Club of Kansas City, Mo.—Regular meeting, June 3. "Sewerage for O. K. Creek District," W. Kiersted and A. J. Morson. Secy., Kenneth Allen, 310 Baird Building.

Civil Engineers' Society of St. Paul, Minn.—Regular meeting, June 3. Secy., Geo. L. Wilson, Asst. City Engineer.

Denver Society of Civil Engineers.—Regular meeting June 4. Secy., W. W. Follett, Tremont Block.

Western Society of Engineers, Chicago, Ill.—Regular meeting, June 5. Secy., John W. Weston, Gaff Building.

Engineers' Club of St. Louis, Mo.—Regular meeting, June 5. "The Olive St. Cable Line," W. Bartlett; "Compound Engines," E. E. Furney. Secy., Wm. H. Eryan, 709 Market St.

American Society of Civil Engineers, New York.—Regular meeting, June 5. Annual convention at Seabright, N. J., about June 20. Secy., John Bogart, 127 E. 23d St.

Association of Civil Engineers, Dallas, Tex.—Regular meeting, June 7. Secy., E. K. Smoot, 15 No. Jefferson St.

Civil Engineers' Club of Cleveland, O.—Regular meeting June 11. Secy., James Ritchie, Case Library Rooms.

New England Railway Club, Boston, Mass.—Regular meeting, June 12. Boston & Albany passenger station.

New England Water-Works Association.—Annual meeting at Fall River, Mass., June 12, 13 14. Secy., R. C. P. Coggeshall, New Bedford, Mass.

Engineers' Society of Western Pennsylvania, Pittsburg, Pa.—Regular meeting, June 18. Secy., S. M. Wickersham, Penn Bldg.

American Railway Master Mechanics' Association.—The annual meeting will be held at Niagara Falls, N. Y., beginning June 18. Secy., Angus Sinclair, 140 Nassau St., New York.

American Institute of Mining Engineers.—Next meeting at Denver, Col., beginning June 18. Secy., R. W. Raymond, 13 Barling Slip, New York City.

Boston Society of Civil Engineers.—Regular meeting, June 19. Secy., S. E. Tinkham, City Hall.

New York Railway Club.—Next meeting, June 20. Rooms, 113 Liberty St., New York City.

Master Car-Builders' Association.—The annual meeting will be held at Saratoga Springs, N. Y., beginning June 25. Secy., J. W. Cloud, Buffalo, N. Y.

WE rejoice to learn that the answers received to the recently issued circular of the Am. Soc. C. E. committee, on the form of rails and wheels, indicate an almost unanimous agreement among the engineers and rail men of the country as to the main details of rail head sections. The responses were so numerous as to include a large majority of the men whose opinion would naturally carry most weight, including officers of all the trunk lines and nearly all the great railway systems, while many of the discussions are very elaborate. Instead of the great diversity of views which was naturally expected in view of the heterogeneous condition of existing practice, there proved to be a majority of 80 or 90 per cent., or even more, on the specific points submitted, which were merely top radius, top and bottom corner radii, vertical or flaring sides, and width of head relative to depth. These are the questions most in dispute in regard to rail sections, and as there seems now to be so good a prospect of practical agreement upon them, there ought to be much less difficulty in agreeing on the less disputed and debatable remaining details of a rail section. If this should prove to be the case, it would bring to an end a long confusion of practice, which has often been commented on as absurd, but which is not really so absurd as it appears; for a long period of experiment and experience was almost a necessity before ideas could really begin to crystallize. There are probably few men who have been careful students of the question who have not changed their ideas about the best form of rail section very materially, once or more. Again, the effort now making is the first serious effort which has ever been made to collate and harmonize views. In the absence of such effort, it was with reason felt that one man's views were as good as another's, and each man preferred his own; while each new section gave each succeeding amateur more ground for assuming that, as preceding designers could not agree among themselves, he could not safely trust to any of them.

THE pecuniary importance of getting some generally accepted standard rail sections is very great, apart from the probable increase in wearing qualities by getting the best section. The direct expenditure for new rails in this country is now from $20,000,000 to $30,000,000 annually. In 1880, with total operating expenses of $352,800,000, instead of $600,250,000 in 1888, the cost of rails for repairs was $17,244,000. The total rail output is now, we may say, 1,500,000 to 2,000,000 tons annually; and, although we cannot refer to any definite authority, and have made no inquiries of manufacturers, it is an estimate which we do not think will be disputed that something over $1.00 per ton would be saved in the cost (and hence probably price) of steel rails. Instead of having the mills lumbered up with rolls for hundreds of different sections, as our mills are now, a single set of rolls for each weight of rail would suffice. In dull times, consequently, the mills could keep at work rolling for stock with a certainty that there would be a market for the rails as soon as demand increased again, and most of the mills have ample capital to carry a very heavy stock in this way. Under existing conditions, with each road using a different section, it is practically impossible to roll except in fulfilment of previous orders. Thus the demand for labor is made unstable and its cost increased; while the expense of keeping mills idle is in the long run charged up in full to the consumers, and must be. To always supply demand, it is necessary that there shall be mills enough to supply nearly the *maximum* demand, when all are at work. With standard rail sections in use, only enough mills to supply the *average* demand would be needed, this meaning plainly a decided reduction in cost of product. Besides these economies, it is probable that rail-sections which were the final result of the united judgment of engineers would have better wearing qualities than the average of those which had only one man's brains behind them, and this would mean a further great economy. There is every evidence that standard rail-sections, approved by fully four-fifths of those concerned, are now attainable, and every one should aid to that end as much as he can.

As the season of conventions is now fast approaching, we think it is for every one's interest that we should suggest to manufacturers, inventors, and dealers that there is no more effective and profitable mode of bringing their goods to the attention of possible buyers (always excepting the liberal use of the advertising columns of this journal) than to exhibit them at these conventions by samples or models, especially in the case of new inventions and appliances involving some departure from current practice. As respects the Master Mechanics' and Master Car Builders' conventions, no such advice is needed. It has become so common a practice that the exhibits constitute a regular mechanical museum, which is one of the most interesting and valuable features of the conventions, and does a great deal to bring new devices of zeal merit to the attention of those interested. But as respects the engineering conventions and the water-works conventions, and even the roadmasters' conventions, this practice is less firmly established or altogether wanting, and thus both sides suffer. We are perhaps talking against our own interests in urging such exhibits, but we will take that chance. The New England Water-Works Association, which holds a convention at Fall River, on June 12, has very wisely sent out a circular inviting such exhibits, and explaining some special arrangements, and this will doubtless result in a better collection of new water-works appliances than ever before; but the very fact that it should be necessary to send out such a circular shows that the opportunity is not appreciated as it should be. The M. M. and M. C. B. conventions have no necessity to send out circulars to ensure very complete exhibits, and as the practice increases, it must be found profitable.

THE Georgia road congress has been adjourned, and while the published addresses contain no special information as to the best methods for improving upon present conditions, they show a lively and extended interest in this important subject and bear promise of fruit to come. Col. J. W. ROBERTSON, the delegate from Habersham, put the status of road affairs into a nut-shell when he made the remark that "our roads are about the only thing that did not feel the shock of the revolution of 1861. They are just the same as they were before the war." And what is true of Georgia is also true of the greater part of the United States. The people, by road congresses, legislative and individual action, cannot too soon devise means and methods for removing one of the most conspicuous blots upon the page of our general advance as a nation. It is the people, after all, who suffer from present bad practice and who must pay for improvement thereon; but if improvement is carried out under wise and intelligent advice, their gain in the end is also great. It is fitting, therefore, that the people should agitate this matter in conventions, as is being done in Georgia, and force upon their representative bodies a recognition of their needs, and other States could follow the example of Georgia with profit.

ONE of the most creditable acts of the late Legislature of the State of New York (whose virtues are apt to be negative) was *not* passing the so-called Green bill for a bridge across the Hudson at New York. No one knew who were behind this bill, if indeed any responsible parties were. It is more likely that it was a mere effort to secure a valuable franchise "on spec"; but all the more if it was a real *bona fide* effort to get authority to build a bridge at once, authority should not have

been granted without prior presentation of definite plans, and approval thereof as the best for the purpose by competent engineering authority. As the bridge will necessarily be a costly one in any case, the inevitable tendency will be to erect a cheap-John affair, which the lapse of a few years will leave anything but an ornament, and very possibly an unnecessary obstruction, to the harbor. We are not prepared to assert with positiveness that a bridge suitable for heavy traffic can be erected spanning the North River without a pier, by a single span; but it is claimed on excellent engineering authority that this can be done, and definite plans to that end were before a Board of six army engineers last summer, and they reported on the project favorably. While the function of the Board was not to pass critically on the design itself, but only on its relation to the water-way, it is not likely that they would have reported in favor of a project which did not commend itself to their judgment as feasible; and in any case it would be an outrage upon a long-suffering public if power to construct, which ought to be carefully controlled in the public interest and for the credit of engineering, were given away blindly, with no assurance that the proposed structure was the best that could be had at reasonable cost, or that there was some probability of construction behind the application for a charter.

The Railway Systems of the Northwest.

III.

THE MINOR NORTHWESTERN SYSTEMS.

Besides the twelve most important systems of the Northwest reviewed in preceding issues, in connection with the colored map of the Northwestern railway systems which appeared in our issue of May 11, there are a number of minor systems and independent lines of enough importance to deserve some description in connection with a complete review of the present railway situation in that section.

The Missouri Pacific and the Atchison, Topeka & Santa Fé, the two chief systems of the Southwest, have each a considerable mileage in the Northwestern States. The Chicago, Santa Fé & California Railway is a new line built by the Atchison company in 1887 from Kansas City to Chicago, 458 miles. A short branch runs to Pekin, Ill. The total extent in Illinois and Iowa is 317 miles. A branch from the Kansas lines of the Santa Fé system was completed last year to the Nebraska State lines, where connection is made with a branch of the Chicago & Northwestern system. There is no probability whatever that any extensions of system in the Northwest will be undertaken for a long time to come.

The Missouri Pacific system has now no lines east of the Mississippi or north of the Missouri river. About 300 miles are now operated by the company in Nebraska. The main line terminates at Omaha, and two branches reach west to Lincoln and Crete. A line has been built in the past two years north into central Nebraska, and now terminates a few miles north of Hastings. The company controls auxiliary companies by which extensive additions can be made to its Nebraska lines, but these are not likely to be undertaken soon, if at all.

The Minneapolis & St. Louis system extends from Minneapolis west to Watertown, Dak., and south to Angus, Ia., with a transverse branch from Mankato to Red Wing, Minn. The total extent is 634 miles. The line from Minneapolis to Albert Lea is operated as a through line in connection with the Burlington, Cedar Rapids & Northern road. The system is also an important connection of the Rock Island main line, and the relations between the two companies have been quite close. The first portion of the system was completed from Minneapolis south 30 miles in 1871. The remainder of the system was built between 1877 and 1883. The only portion of the system securing much through traffic is the link from Minneapolis to Albert Lea, already noted. The company's revenue has fallen off with the increase of competition in the Northwest; and it became necessary a year ago to place the property in a receiver's hands, where it still remains. In 1887 the net earnings above operating expenses were only 28.7 per cent. of the gross earnings. It is quite probable that the lines of the system when reorganized will be absorbed by some of the larger systems.

The Milwaukee, Lake Shore & Western system extends from Milwaukee northwest to Ashland, Wis., 387 miles. Branches in the mining and timber districts of northern Wisconsin bring up the total extent of the system to 639 miles. The main line of the system reaches the Gogebic mining district, and in 1888 the tonnage of iron, lumber, minerals, and forest products was 1,764,072 tons, 83.2 per cent. of the whole freight traffic. Construction was begun on the company's lines in 1871, and the road was completed from Milwaukee to Wausau by 1880. The extension to Ashland was finished in 1885. The growth of the system has been an unusually regular one, both in mileage and traffic. Its financial returns are very good. The surplus receipts above operating expenses, taxes, and fixed charges were $739,000 in 1887, and $496,000 in 1888.

The Milwaukee & Northern Railway consists of a single main line, extending from Milwaukee to Champion, Mich., 263 miles. There are only a few short branches and spurs. The total extent of the company's lines is 332 miles. The first 100 miles from Milwaukee north was completed in 1874. The extensions north have been built during the past five years. A large proportion of this system's traffic, like the preceding, consists of mineral and forest products.

The Duluth, South Shore & Atlantic system, 537 miles in extent, lies almost wholly in the north Michigan peninsula. It reaches from Duluth, Minn., to Sault Ste. Marie, Mich., 410 miles, with a branch to Mackinaw straits, and another north to the famous Lake Superior copper mines. This company was formed a little more than two years ago by the consolidation of several of the smaller companies operating north of the straits of Mackinaw. Since then it has completed its line westward to Duluth, with the exception of a short link west of Ashland where trains are now run over the Northern Pacific tracks. The system is carrying a heavy traffic of lumber, ore, and forest products and is showing very gratifying earnings. Since its completion the system has come under the control of the Canadian Pacific, with which it connects to form a through line from Duluth to the East. The only further additions which seem likely to be made to the system are short local feeders to reach and develop the mining districts.

Turning to the railways running southwest from Chicago, the Chicago & Alton system ranks first in importance. Its main line extends from Chicago to St. Louis and Kansas City. The distance from Chicago to Kansas City is 488 miles. The total extent of the system is 849 miles, of which 75 miles is double track. A branch in Missouri runs south to Jefferson City, and in Illinois branches reach Peoria and the coal region south of Joliet. The first charter for a line of the system dates back to 1847. In 1859 the company operated a line from Joliet to East St. Louis. The Kansas City extension was completed in 1879. Since that time no extension of any importance has been undertaken. The company has paid dividends to its stockholders in every year since 1863, a total of 220 per cent. The policy of the company in the past has been so conservative in the matter of extensions that it is not at all likely that any important extensions will be undertaken for a long time to come.

The Wabash and Wabash Western systems comprise 2,100 miles of railways, which on Dec. 31, 1883, were operated with about 1,400 miles of other railways now independent, as the Wabash, St. Louis & Pacific Railway system. The lease to the St. Louis, Iron Mountain & Southern Co. took place three months later, and on May 28, 1884, the property was placed in the hands of receivers. Lines west of the Mississippi with an extent of 734 miles were reorganized in 1887 as the Wabash Western, and 362 miles of the old system in eastern Illinois and Indiana were also turned over to that company by the Court. A fortnight ago representatives of the Wabash Western Co. purchased at foreclosure sale the lines of the Wabash system east of the Mississippi river, and it is intended to consolidate them with the Wabash Western to form a single system extending from Detroit and Toledo to Chicago, St. Louis, and Kansas City, with branches to Des Moines and Omaha, and a considerable system of branches in Illinois, as shown on our map. Both the Wabash and the Wabash Western roads have shown themselves capable of doing a fair business since they have been in a receiver's hands; and with the entire system consolidated under one management and intelligently operated, the prospects seem good for its steady prosperity. Many of the independent lines in Illinois, Iowa, and northern Missouri were formerly a part of the Wabash system, and it is possible that they will be again united with it when the new managers get their property in hand.

One of these independent lines shown on our map is the Keokuk & Western, extending from Keokuk to Albia and Van Wert, Ia., 172 miles. Others not shown in color are the Quincy, Omaha & Kansas City; the Cairo, Vincennes & Chicago; the Toledo, Peoria & Western; the Omaha & St. Louis; the St. Louis, Alton & Springfield; and the Des Moines & Northwestern.

Of the system owned by the Chicago & Eastern Illinois and the Chicago & Indiana Coal companies, only a part is within the limits of our map. The lines extend from Chicago south to Indiana. A branch runs southwest from Danville to Tuscola, Ill., which it is proposed to extend to St. Louis. The system is located through a fine agricultural country, but its heaviest traffic is in carrying the output of the coal fields at its southern terminus to a market at Chicago. The Chicago & Eastern Illinois Railway was built in 1871. Most of the mileage of the Chicago & Indiana Coal Railway has been built during the past ten years.

The Green Bay, Winona & St. Paul Railway was built in 1873 from Green Bay, Wis., west to the Mississippi river. The line is now owned by the same capitalists who control the Delaware, Lackawanna & Western system. A project has long been agitated for an extension across the Mississippi river at Winona, Minn., and thence southwest. About 20 miles of this road was built last year; and if capitalists can be persuaded to furnish the funds, the road will be built on south-

west, probably to Omaha. Our map, showing clearly and correctly the different competing lines which already penetrate this section, and the interests with which the new road will have to battle, is of great interest in connection with this project and will well repay careful study.

The St. Paul & Duluth Railway has been, until a short time ago, the only direct road from the Twin Cities to Duluth. Its main line is 152 miles in length and there are about 80 miles of short branches. The main line was built in 1870, and since 1880 it has been a profitable line for its stockholders. The construction of a competing line to Duluth by the Manitoba company during the past year, however, has diverted a large traffic from the line and greatly decreased its profits. A project was agitated a year ago for an extension of this road from St. Paul southwest in an air line to Omaha, Neb. The project was favored by the managers of the company, but was discountenanced by the stockholders, who made a change in the management at the first opportunity. There is little likelihood that the scheme will be carried out.

It is a somewhat difficult matter to determine just what proportion of the total mileage of the Northwest is comprised in the great systems, because we are obliged to make an arbitrary division at the State boundaries, excluding thus northern Missouri, which is properly classed with Iowa and Nebraska, but including southern Illinois, which is really Southwestern territory. However, the total mileage of railway lines in the States of Illinois, Wisconsin, Iowa, Minnnesota, Dakota and Nebraska is 38,600 miles. Adding to this the mileage of the lines in the North Michigan peninsula (the portion of the State north of Mackinaw straits) we have 39,816 miles as the total extent of the railways of the Northwest. A careful summary of the railways within these boundaries forming parts of systems 500 miles or more in extent, shows a total of 35,680 miles, leaving but 4,136 miles as the extent of the small systems and local roads within this territory. The percentage, therefore is: local lines 10.4 per cent.; lines in systems 89.6 per cent. In our review of the Southern systems we found that 23 per cent. of the railways in that section were local independent lines; while in Canada and New England these form 26 per cent. of the total mileage. It is thus plain that the preponderance of the great systems forms a chief feature of the Northwestern railway situation. A study of our map shows this even more forcibly than any figures could do. Were it not for the scattered fragments of the old Wabash system and the considerable number of local lines in Illinois, the great systems outlined upon the map would constitute practically the whole of the railway mileage.

It will be readily conceded that, with the exception of the trunk lines between Chicago and the East, in no section of the country has the standard of railway maintenance and operation been so high, in proportion to the means at hand, as in the Northwest. Those who are conversant with railway operations will not hesitate to connect this fact with the preceding, and declare that to the preponderance of the great systems in the Northwest is due a large part of their success in attaining a high standard while operating in a new and none too profitable country.

THE NEW SILVERTON RAILROAD in Colorado is about 15 miles long, and is on an almost continuous 4½ per cent. grade, rising to an elevation at Ironton of 11,113 ft. It is of 3-ft. gauge, and has maximum curves of 30° and plenty of them. It has also two switch-backs. The general direction of the route is tolerably straight.

A Free Advertisement.

It is not the usual custom of this journal to use its editorial columns for advertising purposes, or to publish any advertisement here or elsewhere on its pages, except for value received after due negotiation and agreement with our business department. But these rules, for this occasion only, we waive for the benefit of Mr. WILLIAM SHULTZ, a Pennsylvania Dutch farmer, who lives in Mayberry township, Montour Co., Pa., about 4 miles from Catawissa, and whom it appears very desirable to advertise liberally, while it appears tolerably certain that such advertising must be done gratuitously if at all.

On Thursday, April 25, 1889, Mr. SHULTZ proposed to take a load of truck to market, and rose about two o'clock that morning to prepare for his trip. Upon going out of doors he saw the light of a fire some distance off in the direction of his father's barn, and arousing his wife, the two, with lantern in hand, hastened toward the scene. Upon ariving at the elder SHULTZ's place they discovered that the fire was still farther away, and was caused by the burning of a wooden trestle where the Sunbury division of the Philadelphia & Erie branch of the Pennsylvania Railroad crossed a small stream known as Shultz's run. Mrs. SHULTZ urged her spouse to go up the road and warn any train which might be approaching, but that worthy declined to do so, saying that he had once before stopped a train and had never received anything for it. Whereupon the pair returned home, and went about their business.

An hour and a half afterwards the Pottsville local freight, consisting of an engine, nine loaded cars and a caboose, came along. By this time the trestle was pretty well destroyed, little being left except two red-hot rails. There being no longer any visible blaze, the engineer of the freight did not discover anything wrong until it was too late to stop. Then, when he did discover it, after whistling for brakes and reversing his engine, he and the fireman jumped, as did one of the brakemen. A moment later the engine and eight cars went into the hole and were burned up. One car and the caboose stopped on the brink. Of those who jumped, the fireman was uninjured and the engineer only slightly hurt, but brakeman MALONE, who took a flying leap just as his car went over, fell into the fire and was badly burned, besides having three ribs broken.

The responsibility for all this suffering and loss of property rests of course directly on the shoulders of the inhuman farmer SHULTZ, who, to gratify a petty spite against the company, did not hesitate to expose its employés to death in its most horrible form.

But how did it happen that the company itself did not know that its trestle was burning for an hour and a half before the early morning train was due? The Catawissa *News Item*, to which we are indebted for the full details of our story, states that a track-walker had been employed on the section until within a short time, when he was discharged to cut down expenses. If this is true, the culpability of the company is but a degree less than that of Farmer SHULTZ.

The most curious part of the affair is the insight which the *News Item's* account gives into Pennsylvania Dutch character. That newspaper, while condemning SHULTZ in the strongest terms, nevertheless explains that it would never do for a railway company openly to reward any one for stopping a train from runnning into a burning bridge, because that would only put a premium on incendiarism, and the track would soon resemble a torchlight procession, with a man every mile or two flagging trains for the expected reward. It must be comfortable for travelers to know that the company discharges its watchmen on wooden bridges to cut down expenses, depending upon the neighbors to warn approaching trains of fire, and then finds that the neighbors will not give the warning without a reward, while the company dare not reward them for fear of encouraging a new industry. If this state of affairs really exists, then those who purpose making a journey through that section will do well to walk.

As for SHULTZ, the managers of dime museums who may wish to secure him for exhibition as the champion wretch, can find him from the directions given above. It is difficult for the ordinary man to comprehend the depth of stolid brutality which could lead a man and a woman both to vent their spite against a company which has neither soul nor body, upon innocent passengers and employés who are rushing on to a probable and painful death, even when they have some just cause for their spite. But when the only cause for it was a failure of the company to pay them in money for a previous warning of the same nature, the act becomes so inhuman as to go far to justify the old doctrine of the total depravity of man. Even the old practice of luring ships upon the rocks by false lights becomes pardonable in comparison. Such wreckers had at least something tangible to gain. We do not know if there be any law to punish such an act; but if not, there ought to be. A long term in State's prison would seem the only proper remedy for Farmer SHULTZ' complaint.

Engineering Progress in 1888.

The following is a brief abstract of the late address of CHARLES COCHRANE, Esq., the newly elected president of the English Institution of Mechanical Engineers, pointing out some of the more recent advances in mechanical science:

Attention is first drawn to the improvement in non-compound locomotives whereby the exhaust steam is prevented from choking the outlet by increasing the area of the exhaust passage and dividing it into two branches, one of which allows the exhaust to pass away as usual, while the other by a descending passage, partially embracing the cylinder, permits the escape of the other half into the exhaust pipe by a more circuitous route. This device was in use on one or more of the locomotives which made the celebrated run to Scotland last year, and at times attained a speed of 75 miles per hour.

Mr. COCHRANE expected to see the respective merits of compound and non-compound locomotives fairly tested this summer by competing roads. He thought there was little doubt that compound locomotives showed a fuel economy of 12 to 14 per cent. and in one case 23 per cent. was named. But there seems to be some difference of opinion as to how far the economy named is due merely to the utilization of the higher pressure of steam, and whether a like economy is not obtainable by raising the boiler pressure 20 lbs. in a non-compound locomotive. The balance of evidence seems to show that the economy is due to the extra pressure of steam, but that this extra pressure cannot be efficiently used without compounding on account of the greater range of temperature occurring in the single pair of cylinders, and because the strain on the working parts from the high pressure of steam in two equal sized cylinders is greater than with the small cylinder of a compound engine. The advocates of a small and large cylinder, of the Worsdell and von Borries type, lay great stress on the fact that the strains are reduced and a softer exhaust obtained.

In regard to canals, Mr. COCHRANE called attention to the growing appreciation of their value as cheapening transport and to the past neglect of these waterways. France is busy in attempting to solve the haulage and propulsion problem and to systematize its inland navigation. Up to 1883 France had spent $210,000,000 on her rivers and canals combined, and Holland, Belgium, Germany

and the United States had made great strides in inland navigation, as compared with Great Britain. This is the more remarkable when it is considered that in the fifty years following the opening of the Bridgewater canal the United Kingdom built 3,000 miles of canal at a cost of $250,000,000. The speaker pointed out as the canals immediately needed in England the following: From London to the Midland counties and thence to Liverpool via the Manchester canal; one from the Midland counties to Gloucester; and third, one from the Midlands to Hull. These should all be walled-in canals to protect them from wash, and the Government should place them absolutely beyond railway influence. Mr COCHRANE then outlined a scheme whereby the Government should either advance the money for construction or guarantee the interest.

Among the engineering triumphs of the period the speaker mentioned the Forth Bridge; the Eiffel Tower in Paris; the Lick Observatory, with its boldness of design combined with the greatest delicacy of manipulation, and the two hydraulic lifts under construction for the Chignecto ship railway. These latter are designed by Mr. BENJAMIN BAKER to lift ships of 2,000 tons 40 ft. into the air and transfer them to a railway 17 miles long. At the Forth bridge the application of hydraulic power had been carried to the remarkable extent of effecting the continuous riveting together of large steel plates having an average thickness of from 3 to 4 ins. through the joints, and in positions 350 ft. above the water surface and stretching out 500 ft., and ultimately 680 ft., from the main pier. This riveting is done by small portable machines working with a pressure of 1,000 lbs. to the square inch, and in exceptional cases up to 3 tons. The power is conveyed to them by small jointed pipes from the engine and compressing plant below; accumulators are dispensed with by a three-throw pump driven by shafting or worked by steam, and depending partially on work accumulated in a heavy fly-wheel. The water is in constant circulation through the pumps and back to them at a very feeble pressure, and a minimum of power is thus required to preserve the tube of water ready for action at the desired moment. When wanted for pressure, a tap stops the current from going back to the pump and throws it upon the piston of the tool. This is the invention of ANDREW HIGGINSON, of Liverpool.

Among railway mechanical improvements are mentioned interlocking signals and points, continuous brakes, the increased weight of rails from 65 and 75 lbs. to 85 and 90 lbs., and the plan for filling the tender tank at full speed by scooping up water from a trough laid between the rails. This latter device is properly credited to Mr. RAMSBOTTOM, Past President of the Institution of Mechanical Engineers: but it is remarkable that it should be pointed out as new in England when it has been in common use in the United States for at least fifteen years, and was originally introduced into this country from England.

In commenting on sanitary arrangements in towns and houses, Mr. COCHRANE referred to the danger in sewage discharge into the sea of a return to the shores of the objectionable matter, as a result of the lighter specific gravity of the sewage water, causing it to float on the surface of the heavier seawater. The case of Bournemouth was mentioned in this connection. The speaker thought that London was throwing away $5,000,000 per annum in its method of disposing of its sewage, and that the proper destination of the daily outflow of 150,000,000 galls. of sewage should be the soil and not the sea.

In contrasting the mechanical facilities of 1786 and 1889, the speaker remarked that at the earlier date Mr. BOULTON'S ideal of work was to turn out from his shops twelve or fifteen reciprocating and fifty rotary engines per year, while in the year past the Baldwin Locomotive Works, of Philadelphia, built no less than 737 locomotives.

The Potable Water Supply of the City of New York.

The ninth annual report of the State Board of Health of New York deals with the potable water-supply of the city of New York, the report being made in compliance with an official application from the mayor of the city that the board make a thorough examination into the sanitary conditions surrounding the sources of supply and storage of water transmitted for consumption. The Board was also to frame such regulations as would afford the largest measure of protection to the inhabitants of New York City against pollution of the water supply. The State Board at once complied with this request and appointed Prof. C. C. BROWN, of Union College, as its engineer, and Mr. EMIL KUICHLING, as consulting engineer.

The report commences with a general description of the Croton water-shed, its rainfall, etc. Two independent inspections of this water-shed have been made, the first in 1884-85 under the direction of the Health Department of New York City, the second in 1888, under the direction of the State Board of Health. This last inspection covers practically every building in the water-shed, and while not entering into the same details as the first report, it gives others of as great importance, giving details of distance and elevations largely by means of maps, and of buildings and villages draining into each watercourse and many of the principal sources of pollution shown by a great number of excellent reproductions of photographs.

The sources of pollution from inorganic matter, due to mining and manufacturing operations, are few; some iron mines and a few factories and shops making up the total. The artificial pollution from organic matter has been found to come from factories, villages, farmhouses, and their adjuncts, from manured fields, from roads, and from vegetation in reservoirs.

The report then gives in tabular form the inspection of the New York City Health Department, and follows it with a very detailed tabular statement of the results of the late inspection. The inspection of 1888 covered the whole water-shed and notes 2,843 houses deserving special mention, as compared with 1879 in the city department report; the difference is due to the greater area and to some increase in population in the interval. The total present population on the 361.82 sq. miles of Croton water-shed is about 25,000 and the total number of animals is estimated at about 33,000. In connection with the maps and illustrations, very full description is given of each town and village in the water-shed and all points requiring special attention.

The chemical analysis of the Croton water was made by Prof. ELWYN WALLER, Ph. D., of Columbia College, who has been almost continuously examining this water since 1872. Omitting the details of his analysis, which are given in full, the comparison with former years may be given briefly as follows: Taking mineral constituents first, we have for *chlorine*, average for 1876, 0.120; last half of 1885 and first half of 1886, 0.280; average for 1888, 0.202. For *hardness*, the maximum between 1873 and 1888 is 3.832 in 1885-86, the minimum is 2.846 in 1878, and for 1888 it is 3.699. For *total solids*, since 1873, the comparison shows a tolerably regular decrease from 7.82 in 1873 to 6.812 in 1888. As judged by these figures the water cannot be said to have declined in quality.

The nitrogenous constituents are then summed up as follows: The data only affords a satisfactory comparison between the complete years, 1885-86 and 1888. The results for 1881 and 1882 are, however, averaged on examinations which, though few in number, are pretty well scattered through these years, so that they may serve for comparison with some reserve. The comparison would stand:

	Nitrogen in nitrate	*Free. Ammonia.*	*Albuminoid Ammonia.*
1881 (*Partial*)	0.0189	0.0015	0.0118
1882	0.0214	0.0018	0.0132
1885-86	0.0457	0.0023	0.0088
1888	0.0452	0.0005	0.0078

These results indicated that the water was in a less satisfactory condition in 1885-86 than in 1888. The tests made in 1881 and 1882 were chiefly in the warmer months, when the ammonias are, as a rule, higher and the nitrates lower than in the colder months. The nitrates are more than doubled in the latter years, and the increase is more than could reasonably be allowed for a difference of season. An examination of the fuller tables shows that at present 0.02 for mixture is exceptionally small, whereas previously, 0.04 was exceptionally high. Free ammonia has also increased in 1885-86, in spite of difference in season, but it diminished materially in 1888.

The methods of disposal of organic wastes in the Croton water-shed are treated of in a separate chapter. Depopulation, while the most effective, is out of the question from its cost, and the general sewerage of the territory is also practically impossible, owing to the scattered population and the fact that there are about 1,000 miles of roads in the water-shed; dry removal is probably the best that could be done.

The prevention of pollution is embodied in a set of proposed rules and regulations for sanitary protection. These rules deal in great detail with the disposal of human excreta, house slops, etc., garbage, manures, and cemeteries. The State Board of Health is given full power of control, and penalties are fixed for any violation of these rules.

Convict Labor on Georgia's Roads.

During the session of Georgia's road congress at Atlanta, Judge EVE, of Richmond Co., Ga., gave some very practical points as the results of working the roads of his county by convict labor. In his county, stone as a surface dressing was exceedingly scarce, and was used only on one road. The roads must be either made of clay or sand. The usual practice was to put clay to the depth of 6 or 12 ins. on the sand roads, and a little sand on the clay roads to harden them. In that climate this formed a very hard road surface, and one that was lasting and stood pretty hard service. Such work is exceedingly cheap, and the clay and sand can nearly always be found close together in Georgia. The cost of working 250 miles of road in Richmond county, including the maintenance of convict labor, and the repairs due to an exceptional flood, amounted in 1888 to $12,000.

Judge EVE though that the best labor for this purpose in his section was convict labor under official State or county control. He was opposed to letting this labor to private contractors because of the temptations to abuse this labor in the matter of food and clothing and in service required. He said that in his county the convicts were "fed well, clothed well, and worked well." He argued also that the people who suffered from the deeds of convict parties, and also paid the cost of maintaining them, were entitled to the fruits of their labor. Judge EVE would transfer every penitentiary convict from private service in coal mines, brick yards, and railways in the State of Georgia to public service upon the roads of the State.

In answer to queries as to methods of working these convicts, the speaker said that in his section the convicts were lodged in tents, which were moved from place to place. Each convict has a shackle upon him with a chain reaching to his belt when at work: at night the tents are pitched near a tree, and a long gang-chain is slipped through the shorter shackle-chains and then locked to the tree. A single guard at night is all that is required. During eleven years they have had only ten escapes by day and two at night, and in that time they have not had a single death from any local cause attributable to service in the chain-gang. The entire cost of maintaining each convict at work, including medicine, food, stock, clothing, hire of guards, and everything except road machines, tools, and mules and carts, was on an average 31 cents per day.

Another speaker, the Hon. W. A. HUFF, remarked that the State and county convicts numbered 2,200, and of these 1,700 were leased out to private parties for a sum that yielded the State only 3½ cts. each per day. The speaker did not believe in using this convict labor in competition with free labor in ordinary manufacturing, but he went into figures to show that for road purposes 1,600 convicts could be worked, including all expenses, for a total of $263,680 per year, as contrasted with similar free labor at $1 per day, amounting to $565,300 per year. The only trouble was in annulling existing laws leasing this labor to private parties, or in other words to secure the convicts for work on the roads. The speaker remarked that what was wanted was a little bold legislative investigation and some sound judicial hearings, and the act of 1876 could be declared a fraud and swindle upon the people of Georgia for the profit of private individuals.

THE FORT SCOTT (Kan.) CEMENT WORKS, established only about a year ago, have a capacity of about 600 bbls. per day of 10 hours, and the demand is ahead of the capacity. The cement is said to be of excellent quality, and well manufactured. Mr. R. P. MCCORMICK, C. E., is president of the company.

The Iron Industry of America.

The history of the iron industry in the United States, says the Birmingham, Ala. *Age*, is truly wonderful. In 1838 the first furnace was built in eastern Pennsylvania. It was 21 ft. high, and made 2 tons of iron per day. The furnaces now are from 60 to 70 ft. high, and produce from 120 to 140 tons per day. The magnitude of the growth is shown by figures:

	Production Tons.	*Imports Tons.*
1828	130,000	47,210
1838	348,000	83,900
1850	900,000	
1870	1,200,000	
1882	4,200,000	600,000

In 1882 the United States consumed in the manufacture 7,200,000 tons of coal and coke; 3,200,000 tons of lime; 8,600,000 bushels of charcoal. Yet this is but one-fifth of the world's production. In 1882 the world's production was 20,000,600 tons, of which Great Britain produced 8,400,000 tons, and the United States 4,200,000.

Malleability in iron is of great use in many ways, and this gave charcoal iron peculiar value; puddling iron is a process to make it malleable without its being taken directly from the ore. In 1882 out of 4,200,000 tons produced in the United States 2,500,000 were puddled. But puddling is rapidly declining since the introduction and use of soft steel. Steel was very anciently made in India. It was first introduced into Europe in the thirteenth century, but being very costly its use was limited to special purposes. The immense developments in the steel industry are the history of to-day. By the Bessemer process, with a simple blast, from 5 to 10 tons of steel are converted in from 10 to 15 minutes, without use of fuel, and at a very little additional cost over iron.

The magnitude of this change is seen from the fact that in 1872 the total product of steel was 2,400,000 tons, while in 1882 it was 6,200,000 tons. In 1872 only 4 per cent. of our iron was made into steel, while in 1882 33⅓ per cent. was converted.

The Brownley Grooved Brake Shoe.

A new form of brake shoe, controlled by Brownley & Co., of St. Johns, N. B., and Chicago, Ill., is now being experimented with on the Chicago & Northwestern Railway after tests on the New Brunswick Railway, the peculiar feature of which is the additional of three transverse grooves across the face of the shoe.

The shoes were patented in 1888, and are made wholly of cast-iron, the idea on which they are based being that what causes shoes to wear out quickly is emery-wheel action, taking place when the shoe is applied to wheel, i. e., that sand and grit and particles of metal get between the shoe and wheel, and cause not only the shoe, but also the wheel, to wear away needlessly by grinding, with a loss likewise of retarding efficiency, since the grinding particles act also, to some extent, as friction rollers. The Mechanical Superintendent of the New Brunswick Railway Co. reports as to a test:

McADAM JUNCTION, N. B., Aug. 2, 1888.

MESSRS. BROWNLEY & CO.:

We have just removed two of the Brownley brake shoes, which have been on the opposite ends of a brake beam, to two of our common shoes under a postal car. When new, the Brownley shoes weighed 17½ and 18 lbs. respectively. The other shoes, 19 and 19½ lbs. respectively. When removed, on July 20, the Brownley shoes weighed 12 and 12½ lbs. respectively, while the ordinary shoes weighed 8 and 8½ lbs. respectively; i. e., the wear of the Brownley shoes was 5½ and 6¼ lbs., while 7,738 the others each wore away 11 lbs., all in a mileage of miles.

The Detroit River Bridge.

The hearings of the Board of United States Engineers in regard to this bridge have come to a close. The proceedings were long and interesting, but somewhat speculative, and it is likely that not much more will be done about the matter until the next Congress. Winter bridge, summer bridge, high bridge, low bridge, tunnel, and navigation interests were all heard from vigorously, and the Government engineers probably know more about the question than they ever did before, or perhaps ever will again. The following are abstracts of some of the evidence:

Capt. W. B. GUYLES, of Cleveland, thonght it would be very imprudent and dangerous for a navigator to attempt to go through an opening of 200 ft. between piers. It often required the entire width of the river to enable a tow to put up at the docks. The St. Clair canal was neither deep enough nor wide enough, though vessels managed to "worry through." The great number of craft and stationary objects in the Detroit river and the smoke hanging over it was very confusing to the lake captains. A winter bridge would be a very serious obstruction to navigation. Witness went on to say that he supposed a bridge with six abutments would take up 400 ft. of room. "You mean piers, not abutments," corrected Mr. MUIR, "and you are also wrong about the dimensions." "I supposed the piers were nearly 100 ft. wide," said Capt. GUYLES. He had not sailed any vessel for 25 years, but he had traveled up and down the lakes constantly ever since, as a part of his business in connection with marine insurance, etc.

After this valuable evidence from the "navigation interest," showing how much intelligence is often behind its opposition to bridges, Mr. H. B. LEDYARD, president of the Michigan Central Railway testified, as follows:

About one and one-half years ago Mr. Ross and Mr. ONDERDONK came to him about a tunnel in the Detroit river, representing a Canadian company. They said the tunnel might cost $5,000,000 or it might cost $15,000,000. The matter dropped right there.

He had known freight rates to be lower in the winter than in the summer. The Michigan Central had expended over $1,000,000 in steamers for crossing the Detroit river. As a rule, during average winters, trains are liable to be delayed on the river two to four hours. The Michigan Central therefore lost a great deal of traffic during the winter, which it was difficult to regain in the summer. While there might be such a thing as a snow blockade, yet the principal delays were caused by the river.

Capt. J. W. MILLEN had navigated the river from 1850 to 1882, and had formerly always been opposed to any bridge scheme, but now he favored a bridge with 1,000 ft. opening. He didn't think a winter bridge such as proposed would interfere with navigation, and couldn't see how 1,000 ft. would be too narrow. He had rounded to with nine vessels in tow in various narrow portions of the river without any serious trouble. He had never heard this called a dangerous harbor. It would be an advantage to navigation if two piers 1,000 ft. apart were placed in the river and lighted with characteristic lights. At present the vessels did not take up more than 1,000 ft. of the river. He was the only one of the Lake Carriers' Association who favored a bridge. That was the occasion of his ceasing to be an officer. He was one of the stockholders and projectors of the bridge. It was customary for ordinary tows to pass within 200 ft. of each other. There might be circumstances, owing to a heavy wind, which would render it prudent for tows to keep 600 or 800 ft. apart. The various lake captains all know that a bridge would not be an obstruction. But if their employer were opposed to it, the captains would say that they were too.

Capt. NICHOLSON said he had been engaged in navigating the lakes from 1845 to 1865 or 1866. He had frequently been called by the district judge as an expert in navigation. He had no interest in the winter bridge or in the railroads. At the last investigation he was on record as opposed to a drawbridge. A winter bridge would not interfere with navigation. He was, generally speaking, opposed to a high bridge. The broad piers in the current of the river would render the steering of vessels difficult, on account of the peculiar forces or currents caused. Capt. NICHOLSON thought that the danger arising from the irregular anchorage of vessels, with the river in its present condition, was greater than it would be with a clear channel, 1,000 ft. wide, marked by characteristic lights. "I don't think that a winter bridge would be any material detriment to the navigation interests of the State," said the captain. It would be a material detriment to navigation to take up two-thirds of a channel with piers or other obstructions. He thought that a 300-ft. vessel would require more space to turn in than one-half her length, but not necessarily twice as much. If a man can't get through a 1,000-ft. channel with a tow, he isn't a competent navigator.

Mr. G. LINDENTHAL, of Pittsburg, Pa., representing the Long Span Bridge Company, and who had prepared plans for a high bridge, made an argument in favor of that kind of a structure. He illustrated the advantages of the high bridge and why it was superior to a tunnel or any other kind of a structure. The bridge proposed by the company represented by Mr. LINDENTHAL is intended to be located at the foot of Eleventh St., and to cross the river at right angles to Windsor, in Canada. The bridge would be continuous and placed so high as not to impede or obstruct navigation on the river. Such a bridge requires necessarily long viaduct approaches, which would be on either side about 7,000 ft. long; the total length of the proposed structure would be about 16,700 ft., or 3.2 miles, and it is intended for a double-track railway. For that part of the bridge over the Detroit river are proposed three long spans, with only two piers located in the river. The clear waterway between the piers would be 1,000 ft., and from the shore spans it would be 700 ft. each. Mr. LINDENTHAL'S report continued as follows: The principal navigation is, as a rule, here confined to the middle of the river, which is deep enough over its entire width for the deepest going vessels. A span of 1,000 ft. in the clear appears amply sufficient to permit of tows meeting under the bridge, even if an unfavorable shore wind should prevent the towed vessels from being in line. For comparison may be mentioned the exceptionally wide barge tows of coal craft on the Ohio river, where a clear width of 500 ft. between piers has been found sufficient for meeting tows, loaded going down stream and empty returning up stream, and both harder to handle than the vessel tows on the Detroit river. The shore spans of 700 ft. each would fully accommodate vessels landing in Detroit and eventually also the ferries, which may be continued more or less in use for local and more immediate passenger traffic between the two cities, and for which a bridge with long approaches would afford no convenient accommodation.

It appears that a wider channel span would narrow up too much the shore spans, so that steamers and other vessels would not have sufficient room to swing out into the stream. The through traffic on the river passing through the 1,000-ft. channel span cannot possibly be inconvenienced, far less impeded, no matter how great it may yet grow from its already magnificent dimensions. The demand has been made that if a bridge be permitted at all, it should be of a single span over the entire river, 2,700 ft. wide. Such a bridge would be impracticable. A suspension bridge is the only kind that could be built of such long span. Good anchorages in rock would be an absolute necessity. Such anchorages are not obtainable at Detroit, where the rock is some 120 to 140 ft. under the surface.

Mr. LINDENTHAL then explained why a tunnel wou not be a good thing. While he admitted that it would be feasible, no one could estimate the cost. The report continued: "In regard to the clear height of the bridge above water, the company represented by the Long Span Bridge Co. referred to the report of the chief of engineers in 1869 on the Brooklyn bridge, where the question of high-masted vessels passing under the bridge has been carefully examined into. It is further respectfully submitted, that the number of high-masted sailing vessels on the lakes is steadily decreasing; that only a few are now over 140 ft. in height to the top-gallant. A height of 135 ft., equal to that of the Brooklyn bridge, would let pass under it more than 95 per cent. of all vessels without change, and only about 5 per cent. would house their top-gallants as long as such vessels exist. It is, therefore, submitted that 135 ft. above high-water would be a sufficient height for all time. The cost of the proposed high bridge is $6,500,000.

At the conclusion of Mr. LINDENTHAL'S report, he was subjected to questions from DON M. DICKINSON W. K. MUIR, Gen. POE, and others.

Mr. DICKINSON then introduced the winter bridge question, giving a brief outline of the scheme, after which W. K. MUIR presented a report on the proposed structure, saying in substance:

We propose to largely exceed the dimensions of these openings, of which your predecessors seemingly approved, and to have them fixed, and not used as ordinary draws, thus giving the vessels not only the undisputed right to the river navigation, but having the openings lighted and tugs in readiness to help, if necessary any rafts in passing through the large fixed opening of 1,000 ft. The vessel interests during the summer and the pressing necessities of the railroad transportation in winter can by this proposed plan both be reasonably served and neither party impeded. The railroads propose to give very much larger channels and fixed openings than the vessels enjoy in the St. Clair Flats above the proposed winter-bridge crossing and at the Lime Kiln crooked channel below the proposed bridge. The cost of this bridge is estimated at $1,250,000.

Mr. HARVEY D. GOULDER, representing the Cleveland Vessel Owners' Association, opposed any bridge. He said he wanted no piers at all in the river, and particularly opposed the winter bridge. He objected to having 1,600 ft. of the river, which is only 2,600 ft. wide at the proposed location of the bridge, blocked up for 12 months in the year with piers. Mr. GOULDER'S argument was a strong one, and the objections to the winter bridge were made very plain and pointed

Mr. GEO. H. ELY, of Cleveland, president of the Western Iron Ore Association, said the object of the association is to improve the water-ways of the lakes upon which products must go to market. In 1888, 5,023,278 tons of ore came down the lakes, of which 3,500,000 tons were from Michigan mines. It was of vast importance to the consumer, therefore, that the ore and other products should be brought down as cheaply as possible. When capital engaged in this business of transportation it was with the understanding that the Government would not murder it, which would be the case if the proposed winter bridge were constructed.

The resolution adopted by the Commission of Engineers of 1879 declared that, in their opinion, the most complete solution of the subject of crossing Detroit river was the construction of a tunnel. But the Michigan Central and other railroads do not desire a tunnel or a high bridge, because they own large amounts of valuable property on the river front, which property would be rendered almost useless by reason of the approaches necessarily being some distance back from the river. In his argument Mr. RUSSEL practically admitted that the Michigan Central Railroad was behind this project.

Mr. ELY said he laid down the first 600 tons of iron rails in the Upper Peninsula. He purchased them in Cardiff, Wales; they were poor things and cost $70 a ton.

Iron ore is now carried from Ashland to Lake Erie ports for $1.25 a ton, when only a few years ago the rate from Marquette to the same points was $3.50 to $4 a ton. The rate on coal from Lake Erie to the mining ports of the North was from 40 to 60 cts. a ton, just about what it cost for cartage a ton in the city of Detroit, while the rate on salt, lime, and cement was 10 to 20 cts. a barrel. All this was due to the cheapness of water transportation. The absolute cost of railway transportation was so much greater that, from many points in Dakota, it ate up all the value there was in the product.

W. K. MUIR said the tunnel had been tried and proven impracticable. He did not think the ore men deserved any sympathy. All the money made in iron has been made by the mine owners and vessel men.

Mr. HENRY RUSSEL, attorney for the Michigan Central, said that formerly there was a slight increase in freight rates after the close of navigation, but now the opening or closing of navigation had little effect. It was formerly supposed that the time would never come when railways could compete with water traffic, but figures prove that the two have now settled to about the same basis. The bulk of the lumber shipped from the Saginaw valley now goes by rail.

Mr. WM. LIVINGSTONE read a letter from Mr. MCBEANE, in which the practicability of a tunnel across the Detroit was demonstrated by the actual experiments that Mr. MCBEANE had made in constructing a tunnel across the Detroit river.

In reply to the statement of Mr. HENRY RUSSEL, that the railroads had not increased the freight rates during the winter months, Mr. LIVINGSTONE produced a freight schedule issued by the Michigan Central, which showed that the rate on copper from Hancock to New York had been advanced from 25 cts. a hundred to 70½ cts. the very day after the boats had stopped running.

Mr. LUTHER BEECHER asked to answer some of the assertions of the bridge promoters. He read specifications and plans for an iron tunnel under the Detroit river. This tubular bridge was offered as a substitute for the high bridge or the hermaphrodite low winter bridge. He offered this as a substitute for all schemes advanced by the bridge projectors, saying, "We will sell the tunnel to the railroads for $2,000,000, with all the rights and franchises appertaining to it." Gen. POE asked Mr. BEECHER to state the price for which and the conditions under which he had offered to sell such a tunnel to the Michigan Central Railroad. Mr. BEECHER said the price named was $3,500,000, and that they would pay the railroad for their right of way, storage, dockage, franchises, and construct the approaches, etc.

Mr. GEO. FARWELL, representing himself, Mr. COLLINS and others, offered to construct a tunnel for $1,000,000. That would correspond in length to the one Mr. BEECHER proposed to furnish for $2,000,000, not including the approaches.

Mr. ANDREW J. LINDSAY presented another tunnel project. His plan was to commence tunneling at the deepest place in the river and work upwards to either side. He claimed that his project dispensed with the sub-tunnel to receive the drainage; also that it would give light and air to the track in the center of the river.

Mr. LINDENTHAL remarked that the sinking of a shaft in the middle of the river, in order to drain such a tunnel as Mr. LINDSAY proposed, would be very expensive. He also criticized Mr. LINDSAY'S scheme as impracticable in consequence of the great pressure of the 90 ft. depth of water in the center of the river. Gen. POE remarked that, in his opinion, a tunnel such as Mr. LINDSAY proposed would cost twice if not ten times as much as any other.

A HYDRAULIC PLANT IN FRANCE is working under a head of 1,640 ft. It is located in the valley of Gresivandeau, near Grenoble, and has been operating a turbine there since 1874-75. M. ARISTIDE BERGIS, an extensive manufacturer of that section, put up in 1869 a 500 H. P. turbine operating under a head of 548 ft. The excellent results obtained then induced M. BERGIS to utilize the greater fall on the same mountain, but about 1¼ miles further away, or 11¼ miles from Grenoble. The flow in the high fall is about 10 cu. ft. per second; the diameter of the turbine is 10 ft. 9 in. and the power obtained is 500 H. P.

Cement Exports from the United Kingdom to the United States, 1884 to 1889.

We have received from the Statistical Enquiry Office, 37 Walbrook, London, C. E., the following interesting summary of the export of cement from Great Britain into the United States in the years 1884-89. The quantities given are in tons:

	TONS.					
	1884.	1885.	1886.	1887.	1888.	1889.
Jan.	2,325	2,680	2,800	5,471	11,755	7,702
Feb.	755	1,720	9,250	11,755	20,531	8,359
March	2,610	4,390	10,235	10,087	29,125	17,337
April	4,240	7,720	8,905	13,183	18,639	30,813
May	4,600	6,955	9,115	20,570	18,926	
June	2,515	3,535	10,430	15,083	19,211	
July	4,670	4,675	7,445	23,951	10,083	
Aug.	4,675	4,755	8,090	20,972	15,119	
Sept.	7,130	5,630	10,985	25,204	10,904	
Oct.	4,415	4 435	5,265	17,906	12,987	
Nov.	2,360	4,520	7,985	17,107	12,286	
Dec.	3,770	2,025	6,415	19,946	7,501	
Tot., U. S.	44,045	53,325	96,800	201,215	187,067	
" world,	387,065	367,895	426,040	506,090	611,328	
Percent.	11.04	14.4	22.7	40 0	30.6	

American Municipal Expenditures.

Mr. GEO. W. ELLIOTT, of Rochester, has made a systematic study of a century's growth of American municipalities, showing many important facts never before similarly grouped. He finds that the cities, up to 50,000 population, average in tax per capita about $6.06; that with from 50,000 to 70,000 population the tax per capita jumps just $3.54, or to $9.60; that with from 50,000 to 400,000 population the per capita of taxation averages just $9.40, and that in cities above 400,000 there is another jump above this average still of $3.27 to $12.67, the national revenue per head being about $5.85. The following group shows both the net debt per capita each of nine cities about the size of Albany and their tax per capita. The population in each case is supposed to be a low but fair estimate.

BETWEEN 75,000 AND 100,000.

Place.	*Tax per capita.*	*Net debt per capita.*	*Estimated population 1887.*
Albany, N. Y.	$17.09	$23.06	98,000
Worcester, Mass.	12.86	28.51	81,000
Syracuse, N. Y.	5.31	14.26	80,000
New Haven, Ct.	6.14	8.50	80,000
Scranton, Pa.	2.27	4.55	80,000
Nashville, Tenn.	14.06	26.25	80,000
Omaha, Neb.	12.44	15.00	80,000
Toledo, O.	7.56	38.67	80,000
Denver, Col.	4.14	5.33	75,000
Average	$9.10	$18.24	

Many American cities have an actual revenue from licenses, franchises, water-works, gas and electric light works and from other "natural monopolies," and these revenues are applied to the payment of the cities' obligations, reducing the tax levy by their amount. From licenses alone Boston receives $625,000 (this sum has just been augmented by over $200,000); New York city $1,400,000; Brooklyn $500,000; Buffalo $263,900; Mobile $125,000; Knoxville, Tenn., $165,000; San Antonio, Tex., $165,000; Chicago, $3,000,000; San Francisco, $465,000; Detroit, Mich., $175,000; St. Louis, $89,000; Milwaukee, $250,000; Kansas City, $152,000; Omaha, $247,000; Minneapolis, $57,000; St. Paul $90,000,; Rochester, $40,500; and Albany $27,000.

THE IMMIGRATION OF A CENTURY was given in a table made public this week as follows. The table contains some typographical errors which we have not attempted to correct, but none apparently of much moment:

Decade.	Total Immigration.	Germans	Scandinavians.	Italians.	French	Dutch.
1821	250,000					
1821-31	143,439	6,761	260	408	8,497	1,078
1831-40	599,125	152,454	2,264	2,253	45,575	1,412
1841-50	1,713,251	434,626	14.442	1,870	77,262	8,251
1851-60	2,598,214	951,667	24,780	9,231	76,358	10,789
1861-70	2,466,752	822,007	135,683	12,982	37,749	9,539
1871-80	2,944,476	757,698	261,065	60,830	73,301	17,237
Total.	10,715,476	3,125,413	441,364	87,574	319,042	48,305

The immigrants not enumerated in respect to nationality, numbering 6,693,778, consisted almo exclusively of English, Scotch, Welsh, and Iris Irish constituting about half. Since 1880 imm tion has averaged about 540,000 per annum.

CORRESPONDENCE.

High-Level Rapid Transit in Chicago.

CHICAGO, May 16, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

In reference to your article "Proposed High-Level Rapid Transit Road for Chicago, Ill.," May 11, allow me to make a few remarks.

The largest blocks inside the business center (between Lake river and 12th St.) are nearly 400 x 400 ft., with alleys running through the middle, and as in all other blocks there would be room for more than one intermediate pier, the maximum span would be about 200 ft. instead of 330 ft, as stated in your paper.

In the original article I say: "The total capacity of 15 *elevators* for 60 persons each, at six principal stations inside the business center, making one round trip in 1¼ minutes, would be 36,000 persons per hour."

The expenses for securing the right of way would be considerably reduced by the fact that about one-third of such roads could run above public alleys.

Yours truly,

H. A. STOLTENBERG.

Drifting Tests of Steel.

MONTREAL SHOPS, C. P. R., May 21, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

In your issue of May 18, I notice some illustrations of drifting tests of structural steel, and understand that Mr. J. J. R. CROES, Chief Engineer of the Sub. Rapid Transit Co. is given the credit for devising this test. "There is nothing new under the sun," and certainly the test is very much older than the date given (March, 1888). It has been in use on the London & Northwestern Railway Co. of England, in the testing department of their works at Crewe, to my knowledge, since 1872, as I personally had tests made, exactly corresponding to those shown, except that the punched hole was ⅞ ins. in diameter. Without going to the trouble of looking up data, I may say, that to the best of my recollection, the softest steel tried drifted out to 2¾ ins. in diameter before failure. This system of testing was in use before I was engaged in that department, but I cannot at present give any information as to who devised or imported it. At the same time it shows that the progress in the improvement in steel making is probably not so great as is generally supposed.

Yours truly,

R. ATKINSON,
Gen. Foreman and Chief Draughtsman.

[This is additional evidence that the test is, as we surmised, quite old in its substance. It is altogether probable that it has occurred to many different minds independently, and been practically used by them. There is still room, however, for useful work in reducing it to definite form and determining its exact limits as an indication of quality. ED. ENG. NEWS.]

The Bilboa, Spain, Harbor Works.

PHILADELPHIA, Pa., May 24, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

We are always on the alert for information as to successful methods at home and abroad relating to the improvement of bars at the mouths of rivers, and when we saw the note in your issue of May 18, 1889, concerning the results which had been accomplished at the harbor of Bilboa, Spain, as stated in "Society Proceedings" of Engineers' Club of Philadelphia, the journal of the French Society of Civil Engineers was at once obtained from the library of the Franklin Institute, and the details sought for of the method which was alleged to have been so successful.

The result was disappointing, as you will easily see from the endorsed synopsis made by Prof L. d'AURIA, since we found no "single concave jetty" in the business, nothing but the commonplace work-a-day parallel rectilinear jetties, such as are old acquaintances with us; and in place of an *assured* gain of 11 ft. simply a scouring away of the bar due to an unusually rapid extension of a single straight jetty; but with this deepening of the channel over the bar follows the old, old phenomenon of rapid shoaling at the outer end of the jetty. From analogy this promises soon to demand a further extension of the jetty to deeper water beyond, and so on *ad infin.*

In this connection it is worth while to note another example of the often repeated fact that the shore sand

movement is due to the currents formed by prevailing winds, rather than to those generated by tidal littoral currents.

I am sure that your desire for reliable statements of the facts in all cases will justify my communication. Very truly yours,

L. Y. SCHERMERHORN.

[We were not responsible for the correctness of the statement referred to, simply giving a report of the proceedings as they occurred. The following is the abstract referred to of the paper on "Improvement of the Entrance of the Harbor of Bilboa, Spain," presented by M. DE CORDEMOY to the French Society of Civil Engineers, February, 1889. ED. ENG. NEWS.]

The city of Bilboa, is situated on the river Nervion, lat. 43° 14', long. 2° 56' w. At the entrance of this river the mean range of tide is about 14.8 ft., which must generate powerful currents both at ebb and flood tide; but owing to the fact that on the east side of the bay there is a sandy beach, and that the predominating winds are from that quarter, sand is continually transported across such currents and deposited right at the river entrance, forming there a bar dangerous to navigation. To destroy this bar, parallel jetties were commenced, about 500 ft. distant from each other, but as these jetties advanced, the bar was found to advance with them. Finally the engineer in charge, M. DE CHARRUCA, satisfied that nothing could be accomplished by working little by little, proposed to extend immediately the western jetty about half a mile reaching a depth of about 23 ft. at low water. This project being carried out in 1885, a quick scour followed which caused the bar to dissipate. But from the last report it appears that at the head of the extended jetties the bottom is filling up all around rapidly, and has already risen about 3.3 ft.

It is doubtful whether an equilibrium will soon be established or a new bar will be formed. Fortunately, the sand beach which feeds the bar is small, and the progress of such bar is necessarily slow.

The Servis vs. Perkins Tie-Plates.

120 BROADWAY, NEW YORK, May 22, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

In your issue of 18th inst. appears a letter signed by Mr. M. R. PERKINS, in which he says: "As to the discussion in the NEWS of the merits of different tie plates, and noticeably of those of the Perkins and Servis plates, I wish, to say that I invented the so-called Servis tie plate in 1879," etc.

In 1883, Mr. PERKINS undertook to make good this claim. The result was a protracted litigation between himself and Mr. SERVIS, which ended in a judgment in favor of the latter upon every point in issue. In rendering decision the court reviewed the whole testimony, and ended by saying: "SERVIS was the first to conceive the first to reduce to practice, and the first to file his application; and must therefore be adjudged to be the prior inventor."

Having been beaten in the attempt to steal SERVIS' invention, he next undertook to sell his own device to our company. I have letters from PERKINS offering to dispose of his entire interest in the concern for a price which, if the patents were of any value, would be ridiculously inadequate.

As to Mr. PERKINS' suggestions of local rot starting from the sinking of the flange of the Servis plate into the tie, and of accumulations of moisture on the plate becoming a source of rot, we know that hundreds of thousands of the Servis tie plates have now been in use upon railroads all over this country and Canada for years, and that no trouble from these sources has ever been experienced.

WILLIAM L. FINDLEY,
President Servis Railroad Tie Plate Co.

[As we admitted Mr. PERKINS' statements, we admit this in response, but while our columns are always open for the discussion of technical questions, they are not open for the discussion of personal and patent-right questions.—ED. ENG. NEWS.]

Sail Propulsion on Railways.

MILWAUKEE, Wis., May 22, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

An article in your paper of issue of May 11, on "Sails on Early Railways," suggests that the sketch of an experience I had in Kansas, some years ago, with "sail power on the track," may possibly have interest.

The utilization of wind as a railway motor has few advantages and some disadvantages. As a traffic motor it has no practical value, being too uncertain; it is neither useful nor desirable for section gangs; it gives too rapid a movement for an inspection of track; in fact, its usefulness is narrowed down to two purposes: viz., for an engineer's party engaged upon a right of way survey, or when running track centers for relining on old track. A hand-car rigged to run before the wind bears the same relation to an ordinary hand-car that a yacht does to a Dutch lugger—it is a source of pleasure, not of profit.

Having made use of such a motor a number of years ago, I will endeavor to state briefly the experience obtained from the use of a sail for propelling a hand-car, when engaged upon a right of way survey for the Kansas Pacific railway, in a region of country where the free air of the prairies swept unobstructedly across them and with a steadiness and force that was extremely monotonous. The mast was made of pine and fastened to the lever standards of the car; the sail was heavy cotton sheeting about 9 ft. sq., which was hung from a pine cross arm and held "taut" with a heavier pine boom. From the appearance of the outfit it might be termed a "square-rigged lugger." Near Salina, Kan., its appearance stampeded a drove of Texas cattle, and the cowboys in charge threatened us with a broadside from their shooters if we "hove" in sight of them again. The speed of the car was very great, especially when the wind was "aft"; when it was "abeam," the car had an ugly tendency to mount the rails. When the weather was hot and the wind unfavorable, the men of the party had strong tendencies to "lay to," for "pumping" a hand-car in the "eye of the wind" is not a favorite pastime with railway men, even with the experienced, brawny section hand.

One day we were sailing along at a rattling rate when we came upon a curve of moderate degree, located upon an embankment. Our course soon brought the wind directly "abeam," and almost instantly the wheels mounted the rails, pitching car and occupants over the embankment and "the ship with all on board, went down." When we had gathered ourselves and the débris together, we found, distributed about equally among the party, several ugly bruises, besides which the main mast was broken short off, and a dilapilated-looking transit lay in the ditch with a broken transit-rod over it. Nothing but the rapidity with which it was executed could exceed the thoroughness of the "spill."

The conclusions to be drawn from our experience are: Whenever you use a sail to propel a hand-car, load the front end with all the baggage you have; it serves to hold the car down. Build the car with overhanging side seats, so that its occupants will be safely out of the way of the rapid movement of the levers, and will have a better chance to jump if a derailment occurs. When the sail is used, the small gear should be detached, so that the arms or lever will remain stationary. Have the brake so constructed that a brake-shoe will be applied simultaneously upon each wheel. When running at high rate of speed, be very careful to apply brakes slowly, and when possible to do so, "lower sail" before applying the brakes. Suddenly applying the brakes at a high rate of speed is liable to cause the car to jump the rails. A car should be built expressly for such propulsion, and so that the platform will be not more than 8 ins. above the ground or the surface of the ties, thus lowering its center of gravity. This can be done by dropping the axle sufficiently between each set of wheels. In 1869, Mr. E. D. MIER, M. E., of St. Louis, and the writer designed a car of this kind, but unfortunately the car shops were burned down and the car with them, when just completed. This ended our experience with such motors.

W. F. GOODHUE.

PERSONAL.

Mr. ARTHUR THROOP has been appointed City Engineer of Greencastle, Ind.

Mr. FRANKLIN JACK has been appointed General Manager of the Jacksonville, Tampa & Key West Ry.

Mr. J. T. JOHNSTON, General Superintendent of the Pittsburg & Western Ry., has resigned.

Mr. V. T. MALOTT, of Indianapolis, Ind., has been appointed Receiver of the Chicago & Atlantic Ry.

Mr. W. F. MOWBRAY has been appointed Architect for the Louisville & Nashville Ry. Co. A large number of improvements are to be made to the buildings of the company.

Mr. JOHN F. BINGHAM, President of the Baltimore & Delaware Bay Ry. Co., has resigned, and Mr. F.L. HALL has been appointed to succeed him.

Mr. JOSEPH W. DONALDSON has been elected Superintendent of the Martha's Vineyard Ry.

Mr. R. H. INGRAHAM, Auditor of the Ohio Valley road, has resigned, and on June 1 becomes assistant to Vice-President M. H. SMITH, of the Louisville & Nashville.

Mr. CALVIN TOMKINS, Assoc. Am. Soc. C. E., has established his principal office for handling construction supplies of all kinds, at 150 Broadway, New York City.

Mr. SAMUEL B. AINSLIE, General Superintendent of the Northern Pacific, will assume the position of General Manager of the Wisconsin Central on July 1.

Mr. J. S. LEEDS has been appointed Traffic Manager of the Transcontinental Association.

Mr. J. T. DOUGLAS has been appointed General Agent for the Green Mountain Railway, with his headquarters at Bar Harbor, Me. This is a short rack railway.

Mrs. C. M. CRAIG, wife of Capt. C. M. CRAIG, Principal Assistant Engineer of the Alabama Midland Ry., died April 13 at Blakely, Ga.

Civil Engineers ASSERSON and CRAVEN, of the U. S. Navy, are appointed on a board with Rear-Admiral D. L. BRAINE to prepare plans and estimates for the improvement of the Navy Yard at New York.

Mr. J. A. ROBERTSON has been appointed Assistant General Manager of the Monterey & Mexican Gulf Ry., office at Monterey. THOMAS S. BULLOCK, 42 Wall St., of New York City, is Vice-President and General Manager of the company.

Mr. W. H. BREITHAUPT, M. Am. Soc. C. E., of Kansas City, Mo., has been appointed the Western representative of the Detroit Bridge & Iron Works, and is prepared to make proposals for bridges, viaducts, roofs and other structural work. His office is at 309, 310 Bairu Building.

Prof. EDWARD B. LEFAVOUR died at Beverly, Mass., May 18. He was connected with the United States Coast Survey for several years, and afterward was associated with Professor GOULD in his geological work. Previous to his last illness he was assistant Professor of Physics at Harvard College.

Mr. DON M. ROBERTS was elected City Engineer of Terre Haute, Ind., last week. The *Express* of that city says Mr. ROBERTS is a student at the Polytechnic Institute, "is young and has but little if any experience in practical engineering,"—a very poor recommendation for the position to be filled.

Mr. J. A. DUNHAM, of Plainfield, N. J., has been appointed Surveyor of Roads of the Union County Board of Freeholders. Mr. DUNHAM is to superintend the construction of the new roads which the county has decided to build. His compensation is fixed at $8 per day with power to employ two assistants at $2.50 per day each.

PUBLICATIONS RECEIVED.

—*Interstate Commerce Commission.* Report and Opinion on Tariffs and Classification in the Southern States. Pamphlet, 9 x 6 ins. 75 pp. Also Report and Opinion on Equal Accommodations and Equal Protection to Passengers on Trains. Pamphlet, 9 x 6 ins. 19 pp.

—*School of Mines Quarterly.* April, 1889. Columbia College, New York.—"The Lundberg Case (Analyses of Iron)," ELWYN WALLER; "Sewerage and Drainage of New Brighton, Staten Island," A. HOLLICK; "Modern Petrography," H. HENSOLDT; Western Union Time System," F. R. BARTLETT and R. P. MILLER; "An Economical Method of Prospecting in Soft Ground," F. S. RUTHMANN; "An Electric Tabulating System," H. HOLLERITH; "Winding Engines," H. W. HUGHES.

—*Journal of the Engineering Society of the Lehigh University*, Bethlehem, Pa. April, 1889.

"Fuel Gas," J. F. MERKLE; "Sidewalk of Stone Bridge across Monocacy Creek," L. J. H. GROSSHART; "Graphical Solution of a Valve Gear Problem," F. A. WEIHE; "Bidone's Experiments on Backwater." Translation by S. W. FRESCOLN.

—*Illinois Society of Civil Engineers and Surveyors.*—Report of the fourth annual meeting, held at Bloomington, Ill., January, 1889. Published by the Society, at Champaign, Ill. 150 pp. Price, 50 cts.

In addition to the report of proceedings and a number of interesting "topical discussions" on several subjects, there are the following papers: "Natural Water Sheds and Weir Drainage Discharge," C. G. ELLIOTT; "Brick Masonry in Engineering," Prof. I. O. BAKER; "Municipal Engineering of Lake View," J. W. ALVORD; "Municipal Engineering of Bloomington; with Specifications,' A. H. BELL; "Sources of Water Supply," D. W. MEAD; "Water Supply of Springfield," S. A. BULLARD; "Sewage Disposal," Prof. A. N. TALBOT; "Pavements," GEO. F. WIGHTMAN; "Electric Lighting for Small Cities," J. H. GARRETT; "Construction and Maintenance of Levees," E. J. CHAMBERLAIN; "Railway Accidents, their Cause and Prevention," S. F. BALCOM; "Nichols Hollow Culvert," E. A. HILL; "Coal Mining," A. C. BRAUCHER; "A New Mexico Coal Mine," GEO. W. RICHARDS; "Progress of Work on the Cairo Bridge," S. F. BALCOM; "Measuring and Computing Earthwork," E. L. MORSE; "A Park Topographical Survey," E. I. CANTINE: "The Subdivisions of Government Sections," Z. A. ENOS; "Subdivision of Anomalous Sections," H. C. NILES; "The Exterior Boundary of Townships," F. HODGMAN; "The Improvement and Development of Eggleston," GEO. K. WHEELOCK; "Race Track Problem," D. H. DAVISON; "A Method of Calculating Area," S. T. ARMSTRONG.

—*Mechanics of Engineering* [*Fluids*].—A Treatise on Hydraulics and Pneumatics for use in Technical Schools.

By IRVING P. CHURCH, C. E., Assistant Professor of Civil Engineering, Cornell University, in charge of Applied Mechanics. New York. John Wiley & Sons. 8vo. pp. 316, 646 cuts, $3.00.

This seems to us a practical and useful work, better adapted for use as a college text-book, however, for which use it is plainly intended, than as a complete treatise for the engineer, as it touches but lightly on many important phases of hydraulics; although every hydraulic engineer is likely to find it useful, and it has some new features.

—*A History of the Planing Mill*, with Practical Suggestions for the Construction, Care and Management of Wood-Working Machinery. By C. R. TOMPKINS, M. E. New York, John Wiley & Sons. 12mo. pp. 222. No cuts, no index. $1.50.

This is an exceedingly practical work by a man, now retired, who was engaged for over 40 years in the manufacture of wood-working machinery. It is somewhat chatty and discursive in style, but pleasant reading as well as instructive, and full of practical hints likely to be of value to mechanical engineers interested in such machinery.

—*Journal of the Franklin Institute.*—May, 1889. Published by the Institute, Philadelphia, Pa. "Amateur Photography in its Educational Relations," CHARLES F. HIMES; "The Manufacture of Bessemer Steels," ROBERT W. HUNT; "The Present Condition of the Philadelphia Water Supply," S. C. HOOKER.

—*National Association of Builders.*—Official Report of the third annual convention held at Philadelphia, Pa., Feb. 12, 13 and 14, 1889. Published by the Association, Secretary, WM. H. SAYWARD, 164 Devonshire St., Boston, Mass.

This report contains the proceedings of the meetings and the reports of officers and committees. Also papers on "Plastering and Stucco Work," "Iron-Work, Past and Present," "Masonry," "Builders' Exchanges," "The Apprentice System," "The Relation of the Architect to the Builder," "The Metric System," and "Trade Schools."

—*Steamed Wells.*—This is a pamphlet issued by the National Water Supply Co., of Cincinnati, O., describing the Wagner steam excavating process of sinking wells.

—*Catalogue of the Berlin Iron Bridge Co.*—Office and works at East Berlin, Conn.

A handsome illustrated catalogue of railway and highway bridges, roofs, stations, corrugated iron structures, etc., built by this firm. The illustrations have the advantage of being made directly from photographs and thus give truthful representations of the structure. A long list of bridges built, with their location and dimensions, and some pages of testimonials, finish the catalogue.

SOCIETY PROCEEDINGS.

Engineers' Club of Philadelphia.—Meeting of May 18, 1889, President WM. SELLERS in the chair; 11 members present. The Secretary presented, for Mr. C. O. VANDEVANTER, two specimens of well-preserved timber; one (part of a cart-spoke) "Dug, March, 1889, from a bank on the 'Tape Worm' R. R., built in 1837;" the other (a section of timber measuring about 8 x 9 in.) "Cut September, 1888, from a timber used in the foundation of arch culvert on the old 'Tape Worm' R. R., built in 1837. The timber has been exposed to the air since shortly after the culvert was built."

Mr. F. J. AMWEG presented an illustrated description of the Market St. cantilever bridge over the Schuylkill river, Philadelphia.

The question may arise in the minds of some readers, why it was that the cantilever design was selected for this place; as it may seem strange to some that a bridge of this class was chosen for highway purposes, and also for a locality where no obstacles existed for the erection of a bridge of a simpler design, I beg leave to answer this question in advance by saying that the city insisted upon having a deck bridge.

A deck bridge with parallel chords would not allow sufficient clearance in the channel of the river for navigation, and at the same time admit of an easy grade for roadway over the bridge.

The only styles that would meet these requirements were the arch or cantilever. The arch was considered objectionable on account of the thrust transmitted to the abutments, which would be difficult to overcome from the fact that it is impossible to obtain a solid foundation on the west side of the river without incurring a great expense to the city, and also assuming the risk of the same trouble occurring again that has already taken place to other bridges in this locality. All things being considered, the cantilever design was selected as the best adapted to meet all requirements of the case, and also as the piers or abutments receive no thrust from the superstructure it at once eliminates the trouble which might have arisen had the arch been adopted.

The bridge which is the subject of this paper crosses the Schuylkill river at Market street, Philadelphia, and connects the city proper with West Philadelphia.

Previous to the building of this bridge the river was spanned at this point by a wooden Howe truss bridge, built to replace a similar one destroyed by fire in 1875.

To go back some years, in September, 1882, City Councils directed that plans and specifications should be prepared for a stone bridge at this point. Plans were prepared by the chief engineer in accordan ce with this resolution, and bids were called for, and received on Jan. 7, 1884, as follows:

Lindenthal & Friday	$1,220,000
Smith & McGaw	1,197,000
H. C. Clark & Co.	1,160,000
R. A. Malone & Son	1,100,000

But as only $300,000 had been appropriated by Council for this work, and the Limitation Act made trouble in providing the additional amount required, the matter lay dormant until the chief engineer submitted the plans herein described.

On June 15, 1886, the city of Philadelphia opened the following bids for the building complete of the entire structure:

Jones & Benner Co.	$311,000.00
Keystone Bridge Co.	308,000.00
Edge Moor Iron Co.	294,449.00
Phœnix Bridge Co.	294,205.00
N. J. Steel & Iron Co	277,638.50
R. A. Malone & Son	271,000.00

R. A. Malone, & Son being the lowest bidders, were awarded the contract. On account of delays caused by the Mayor vetoing the ordinance, the work was not commenced until Sept. 7, 1886.

On May 23, 1887, the masonry was entirely completed, and immediately the erection of the superstructure was started. The cantilevers were connected Aug. 30, and Oct. 28 the entire superstructure was finished, except some few matters pertaining to the track.

On Feb. 15, 1888, the cable connection was made on the east-bound track, and on the 18th of same month the connection was made on the west-bound track.

The structure was entirely completed in all its parts on May 1, 1888, although the bridge was opened for travel at an earlier date.

Then follows an elaborate description of the substructure and superstructure, strain sheet, tables of results of tests of materials, etc.

There was some discussion by Prof. L. M. HAUPT, Mr. FREDERIC GRAFF, President WM. SELLERS and others.

HOWARD MURPHY, *Secretary.*

Boston Society of Civil Engineers.—The regular monthly meeting was held May 15. President DESMOND FITZGERALD in the chair; 54 members and 8 visitors present.

Mr. WALDO E. BUCK, Lake Village, N. H., was elected a member of the Society.

Mr. J. A. TILDEN, for the Committee to confer with other scientific societies in Boston upon the practicability of occupying common headquarters, submitted a report which was accepted.

Prof. ALLEN, for the Committee on Excursions, suggested the advisability of printing, with the notices of the meetings, a list of engineering works in progress which members might visit. The Committee was requested to prepare such lists and print with the notices.

A paper was read by Mr. JOHN A. GOULD, Jr., describing the high-service system of the Boston water-works. The area of the districts supplied by the high-service works has increased by the annexation to Boston of Dorchester, West Roxbury, and Brighton, from 760 acres when the works were built in 1869, to 11,500 acres at the present time. The paper, after briefly mentioning the gradual enlargement of the works, was confined principally to a description of the recently completed pumping station at Chestnut Hill and the Fisher Hill reservoir.

Mr. CHARLES E. HABERSTROH read a paper giving a description of experiments recently made under direction of Mr. DESMOND FITZGERALD, to determine the coefficient of flow through gates used on the Boston water-works. The flow over a wide crested dam was measured on a weir 20 ft. in length, curves of flow plotted, and comparisons made with the Francis formula for flow over the Lawrence dam. The flow through gates with about 5 sq. ft. of area and under 40 ft. head was measured over a similar weir and coefficients given.

S. E. TINKHAM, *Secretary.*

Engineers' Club of Kansas City.—An adjourned meeting was held May 20; J. A. L. WADDELL in the chair.

A paper on "The Inspection of Iron Bridges" was read by Mr. HENRY GOLDMARK. He referred to the action taken by the Club in regard to highway bridge reform, but considered the safety of railway bridges as of even greater importance. While the earlier long-span bridges are quite satisfactory, he considered a large proportion of the shorter spans to be far from perfect, and the experience of the New York and Massachusetts Railroad Commissions was referred to as corroborating this opinion. The author thought that the reason for this unfortunate state of things lies mainly in the fact that bridge designers as a rule see little or nothing of their work when it is in use. He suggested as a remedy the inspection of all railway bridges by specialists.

KENNETH ALLEN, *Secretary.*

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Keyport.—Work has been commenced on the extension of this road from Lorillard's brick works to Atlantic Highlands, N. J. The road is to be completed by August 1.

Western Counties.—Work is being pushed on the extension of this road from Digby to Annapolis, N. S., a distance of 20 miles.

Irondale, Bancroft & Ottawa.—It is announced that this company will continue the extension of its road from Irondale, Ont., east to Gooderham, a distance of 10 miles. CHARLES HUTCHINSON, of Irondale, is Chief Engineer.

Somerset.—This company has bonded its line from Embden to Bingham, Me., 10¼ miles, to raise funds for its further construction. Grading is making good progress.

Deer Creek & Susquehanna.—Work has been resumed on this Maryland road by the contractors, McCabe & Bro., who have about 40 men and teams at work on the road between Priestford Bridge and Stafford. From Priestford Bridge to Kyles the line will be changed to avoid some heavy curves. The engineers are now establishing the grades.

New York, Ontario & Western.—This company has let the contract to build the extension of its line from Hancock, N. Y., to Forest City, Pa., to Lathrop & Elsworth, of Corning, N. Y., and from Forest City to Scranton, to Dowling, Kennedy, & Co., of Binghamton, N. Y. It is reported that this company is considering the building of a spur line from Campbell's Hall to Montgomery, N. Y., to connect with the Wallkill Valley branch.

The courts have decided in favor of this company in the case arising from the dispute about the right-of-way of its Ontario, Carbondale & Scranton branch owned by the Delaware & Hudson Canal Co., at Carbondale, Pa.

Gettysburg & Harrisburg.—The preliminary survey for the proposed extension of this road from its present terminus at Round Top, Pa., to Washington, D. C., has been completed. The road will pass through the counties of Carroll, Howard and Montgomery in Maryland, and trains will enter Washington over the Pennsylvania tracks.

Zanesville & Ohio River.—The Shawnee & Muskingum River R. R., which runs from Shawnee Junction to Shawnee, O., with a branch from Buckingham to Gloucester, will be opened for general traffic Monday, June 3.

Wheeling & Lake Erie.—The City Council of Steubenville, O., has granted this company the right of way into the city for the proposed line from Portland to Steubenville. According to the agreement, the road is to be finished by Jan. 1, 1890.

Pittsburg & Lake Erie.—This company has opened the Brady's Run branch to business. The road runs from near Fallston north about 2 miles, and will open up extensive coal and fire clay deposits.

Central New England & Western.—The five companies of the Poughkeepsie Bridge system have been consolidated under this name. It is stated that the company will issue $2,500,000 of 6 per cent. bonds, covering the whole system, to take the place of the bonds now held on separate portions of the property.

Pennsylvania.—It is announced that the Schuylkill Valley branch will be extended to Tombicken to connect with the Sunbury, Hazelton & Wilkesbarre R. R., also owned by this company.——Two additional tracks will be laid on the Philadelphia, Wilmington & Baltimore R. R. from Philadelphia to Baltimore, making this a four-track road.——JAMES MCCREA, General Manager of the system west of Pittsburg, denies all knowledge of the reported extension to Detroit.

Projects and Surveys.

Orange & Watchung Mountain.—This company was incorporated several years ago to build a line of railway from Bound Brook, N. J., via Dunellen, North Plainfield, Springfield, and Orange to Hoboken, connecting with New York by ferries at Fourteenth and Twenty-third Sts.; but owing to difficulties in securing right of way but little was done by the company. It is now announced that the right of way has been obtained and that the road will be built.

Oneonta & Earlville.—About 20 miles right of way and $40,000 in cash has been promised in aid of this enterprise by the people along the route. The road is projected to run from Oneonta to Earlville, N. Y., a distance of 42 miles.

Cincinnati & Ohio River.—It is announced that the right of way has been secured for this road and that work on construction will commence soon. The road is projected to run from Gallipolis to a point on the Cincinnati, Washington & Baltimore R. R. near Oak Hill, O., a distance of about 25 miles. E. C. DAWS, of Cincinnati, O. is President.

Rome & Carthage.—Locating surveys are in progress on this road, which is to run from Rome to Carthage, N. Y., a distance of about 70 miles. J. C. SMITH, of Rome, N. Y., is President.

Littleton & Franconia.—The project of building a railway from Littleton, N. H., via Bethlehem and Franconia to Fabyan's, a distance of about 12 miles, is again being agitated. Hon. A. S. BATCHELLOR, of Littleton,

is at the head of the enterprise, and THOMAS PEARSON, of Nashua. N. H., is Chief Engineer.

SOUTHERN.—Existing Roads.

South Brunswick Terminal.—McDermid & Ross, of Brunswick, Ga., the contractors, have advertised for bids for the grading, ties and timber work on this road for sections from one to five miles. The total length of the road will be 16 miles.

Prince George Lumber & Transportation.—A correspondent sends us the following information concerning this road:

The contract for building the Black Water River extension of this road a distance of 7 miles has been let to W. Miller, of Disputanta, Va. The contract for building the Disputanta branch will probably be let within a month. The length of this branch is 8 miles. This will make, with the road now in operation, a line 25 miles long running from Fort Powhatan wharf on the James river to near the Norfolk & Western R. R. at Disputanta, where there are large lumber mills in operation. JNO. L. WEBB is Chief Engineer and JAS. G. HARRISON is President; both of Disputanta, Va.

Louisville & Nashville.—It is stated that this company will expend about $500,000 in double tracking during this season. The most important will be the construction of double tracks from Louisville, Ky., to Anchorage, 12 miles, from Louisville to Shepherdsville, 15 miles, from East Nashville, Tenn., to Edgefield, 9 miles, from Birmingham, Ala., to Graves, 5 miles, and from Birmingham to Boyles, 3 miles.——The people of Clarksville, Tenn., are trying to induce the company to build a line from Clarksville to Dickson, a distance of 35 miles.

Florence Northern.—The Alabama and Tennessee divisions of this company have been consolidated under the above name.

Lynchburg & Durham.—The graders are now at work near Durham, N. C., and tracklaying will begin on that division soon.

Kentucky Midland.—Tracklaying has been completed on this road between Georgetown and Frankfort, Ky.

Cape Fear & Yadkin Valley.—The factories along the route have subscribed the necessary amount to build the extension from Millboro, N. C., to the Columbia factory, a distance of 9 miles. It is stated that work will begin at once.

Ohio River.—It is reported that this company will build a line from Ravenswood to Spencer, W. Va., a distance of 80 miles, and that work will begin within a month. Surveys were made some months ago.

Ohio Valley.—The inclines on the Ohio river near Evansville, Ind., have been completed and are in operation.

Richmond & Danville.—This company has secured trackage rights for the Georgia Pacific Railway from Greenville, Miss., to Arkansas City over the Louisville, New Orleans & Texas tracks. This obviates the construction of the independent line to Arkansas City which has been contemplated.——The tracklayers on the High Point, Randleman & Asheboro R. R. have reached Randleman, N. C.

Projects and Surveys.

Anniston & Northeast Alabama.—We have received the following information from ROBERT LAWRENCE, of Cedar Bluff, Ala.:

The stock subscription books of this company will be opened June 12, and it is expected that surveyors will be put into the field by July 1. The road is to run from Anniston, Ala., over the most favorable route to a point on the Georgia State line at or near Alpine, Ga., about 68 miles, crossing the Coosa river at Cedar Bluff, Ala., and connecting with the Chattanooga Southern R. R., at Alpine. The work will be light, with very easy grades and curves. There will be two large bridges over the Coosa and Chattanooga rivers near Cedar Bluff. The route is through a region rich in red and brown hematite iron ore, manganese, needle-ore and coal, and forests of hard wood and long-leaf yellow pine. No right-of-way or other local aid has been secured. The company was incorporated April 30, 1889.

Anniston & Montgomery.—The preliminary survey of this Alabama road is completed and the contract for construction is let to the Alabama Construction Co. Mr. C. C. WRENSHALL is Chief Engineer.

Atlanta & Alabama.—L. E. O'KEEFE, of Atlanta, Ga., writes us as follows concerning this enterprise:

The preliminary surveys have been completed and the maps, profiles, and estimates made for this road, which is to run from Atlanta, Ga., via Carrollton, Rockford and Mountain Creek to Selma, Ala., a distance of 180 miles. The route is through a rolling forest country affording light grades and easy curves. The principal sources of traffic will be cotton, coal, and the through trade between the Atlantic cities and the West. A large portion of the right of way has been secured and local aid to the amount of $300,00 together with 200,000 acres of land has been promised. The company was incorporated Dec. 26, 1886.

Mobile & Gulf.—A project is on foot to connect Mobile, Ala., with the deep waters of the Gulf by means of a line of railway. The proposed road will run from Mobile to Alabama Port, a distance of about 25 miles, and from this point a channel would be dredged to what is known as the "Lower Fleet" in Mobile Bay, about 3½ miles. J. COLIN MOORE, of Mobile, is interested.

Meridian Belt.—At a meeting of the directors recently held, it was voted to commence the location and construction of this line at once. J. M. P. HAMILTON, of Meridian, is Chief Engineer.

Atlantic, Atlanta & Great Western.—GEO. T. FRY, of Atlanta, Ga., President, has sent us the following information concerning this enterprise:

The surveys for this road, which is to run from Atlanta, via Henderson, Eatonton, Sparta and Springfield to Savannah, Ga., a distance of 270 miles, have been completed. The maximum grade is 66-ft. per mile, and the maximum curve is 6°. The route is through a level, fertile and well populated country rich in forests of long-leaf yellow pine. There will be three large bridges. All of the right of way has been secured, and $250,000 cash has been obtained from the people along the route. Contracts for construction will be let about June 1.

The building of 150 miles of this road will bring into connection 572 miles of railway belonging to no other system, viz. the Georgia Midland, the Covington & Macon, the Georgia & South Florida and the Augusta & Sandersville railways. There is at present no connection between this road and the others as named, but it is hoped to create a system by establishing traffic agreements between them for the present, looking to a closer alliance in the future.

Florida.—Bills have been introduced into the Florida Legislature to incorporate the Florida & Alabama R. R. Co. and the Brooksville & Lacoochee R. R. Co.

Eufaula & Richland.—A company is to be incorporated to build a railway from Eufaula to Richland, Ala.

THE NORTHWEST.—Existing Roads.

Louisville, Evansville & St. Louis Consolidated.—The Louisville, Evansville & St. Louis R. R. Co., the Illinois & St. Louis R. R. & Coal Co., the Belleville, Centralia & Eastern Ry. Co., the Venice & Carondelet Ry. Co., and the Huntingburg, Tell City & Cannelton R. R. Co. have been consolidated under the above name. The capital stock is $1,300,000 preferred, and $3,790,747 common stock. Among the directors are D. J. MACKEY, C. C. BALDWIN and E. O. HOPKINS. The principal offices will be at Belleville, Ill.

Chicago & Northwestern.—Surveyors are at work on the extension of the Fremont, Elkhorn & Missouri Valley R. R. to Deadwood, Dak. It is stated that work will commence soon.

Winona & Southwestern.—This company will build their main line to Omaha instead of Sioux City as was intended. The old grade of the Iowa Pacific will be used for about 80 miles of the distance. THOS. SIMPSON, the Secretary, is reported as saying that the necessary funds had been secured and that the road would be completed within a year.

Northern Pacific & Manitoba.—The contract for grading 50 miles of the Morris-Brandon branch of this road has been awarded. The successful tenderers are: Egan Bros., of St. Cloud, Minn., 15 miles: D. Mann, 10 miles; J. A. McArthur, 10 miles; Dennison, 5 miles; Irwin & McNierny, 5 miles, and McCrimmon, 5 miles. The lowest bid was 7 cts. per cu. yd. and the highest was 28 cts. per cu. yd.

Duluth & Winnipeg.—The officers of this company state that the road will be completed to the Mississippi river this season.——It is announced that the Minneapolis & St. Cloud R. R. is preparing to contest the validity of the swamp land grant to this road. The Minneapolis & St. Cloud has earned about 400,000 acres, which have not yet been deeded to it by the Governor, and as there is not sufficient land available to satisfy both grants it proposes to contest the swamp land grant on the plea that the act granting the land to its company is the older one.

Missouri Pacific.—The Kearney & Black Hills R. R. Co. has been chartered in Nebraska in the interest of this company to build a line of railway from Kearney through the counties of Buffalo, Dawson, Custer, Logan, McPherson, Grant, Sheridan, Box, Butte and Sioux, to a point on the Dakota State line, with branches from Kearney through the counties of Buffalo, Hall, and Adams, to a connection with another railway to be constructed into Adams county, and from a point on the main line to Broken Bow. The principal offices will be at Kearney, Neb. Among the incorporators are WM. C. TILLSON, JOSIAH L. LOMBARD, and FINLEY BURKE.

Northern Pacific.—It is stated that surveys for the extension of the Jamestown & Northern R. R., from its present terminus at Minnewaukan, Dak., to Leeds station on the St. Paul, Minneapolis & Manitoba R. R., have begun.

Projects and Surveys.

Forest City & Watertown.—The locating survey of this road between Forest City and Gettysburg has been completed. J. J. S. HASSER, of Forest City, Dak., is Secretary.

Norfolk & Yankton.—The surveyors are making rapid progress on the location of this line, from Yankton Dak., to Norfolk, Neb., about 60 miles. JAS. H. TELLER, of Yankton, is President.

St. Louis, Grand Tower & Southern.—It is stated that parties in St. Louis have offered to build this road from East St. Louis to the Kaskaskia river this season. The road was projected to run from East St. Louis to Grand Tower, Ill., a distance of about 80 miles. THOMAS N. CHASE, of Waterloo, Ill., is President.

Decatur City Southwestern.—Incorporated in Iowa to build a line of railway from Decatur City south into Missouri. Among the incorporators are: B. F. FOLSOM, T. C. SERWOOD and A. C. BARSTOW. The principal offices will be at Des Moines, Ia.

THE SOUTHWEST.—Existing Roads.

Kansas City, Wyandotte & Northwestern.—The people of Wichita are anxious to secure the proposed extension from Kansas City southwest, to be known as the Kansas City, Lawrence & Wichita Railroad. The company is now endeavoring to secure right of way and terminal facilities for its road through the city of Lawrence. It is stated that the managers of the company contemplate an early extension of the line beyond Wichita to the Oklahoma region.

Fort Worth & Rio Grande.—About 12 miles have been graded on the extension from Granbury, Tex., southwest and the contractors are now at work in Erath county.

Cleveland, St. Louis & Kansas City.—Arrangements for reletting the contract on this road are nearly completed and work will soon be resumed from Hamburg West. Trains are now running from St. Charles to Hamburg, 18 miles.

Houston, Central Arkansas & Northern.—This road, on which graders are now working north and south from Monroe, La., was originally projected to run on the south from Monroe down the Ouachita and thence west via Alexandria to a terminus at Houston, Tex. It is now planned to run from Alexandria down the Red river and via Marksville, Armandville, Breaux Bridge, St. Martinsville, and New Iberia to Morgan City, and it is probable that right of way and local aid will be offered in aid of the extension.

Red River, Sabine & Western.—JOSEPH RATICAN, Manager of the Ft. Worth Construction Co., which has the contract for building this road from Nacogdoches to San Augustine, Tex., states that several miles are already graded. Piers and bridge timber are to be cut and brought to the line, a locomotive has been received, and as soon as the rails are purchased, tracklaying will begin.

Missouri, Kansas & Texas.—Judge BREWER of the U. S. Circuit Court has filed an order authorizing Receivers EDDY and CROSS to complete the Dallas & Waco extension from Lancaster to Waxahachie, and to build a viaduct over the company's tracks at Denison, Tex. J. H. HILL, the receiver's secretary, has filed a statement of the expenditures from November, 1888, to May 7, 1889. The most important are the Dallas & Lancaster extension, $127,886; 15 Mogul engines $120,000; side tracks to gravel beds in Indian Territory, $23,000.

Southern Pacific.—On the Victoria extension, the tracklayers have reached Goliad and are working toward Beeville.

Projects and Surveys.

Washburn & El Paso.—A company has been organized to build a railway from Washburn to El Paso, Tex. J. P. SMITH, of Washburn, is President.

Sulphur Springs & Red River.—This company, recently incorporated in Texas, will build a railway from Sulphur Springs to a point near Ragsdale, Fannin county, a distance of 60 miles. J. A. B. PUTNAM, P. S. FOSCUE, C. B. STEPHENSON and others of Sulphur Springs are interested.

Weatherford, Mineral Wells & Northwestern.—The preliminary survey has been completed for this road, which is to run from Weatherford to Mineral Wells, in Texas, a distance of 12 miles. It is stated that construction will commence at once.

Spokane Falls & Northern.—Two locomotives and a number of flat cars have arrived at Spokane Falls, and the track layers are to begin work at once. About 45 miles from Spokane Falls are graded, and it is hoped to have trains running to Colville, 50 miles north, by September.

ROCKY MT. AND PAC.—Existing Roads.

Seattle, Lake Shore & Eastern.—It is announced that $2,000,000 has been raised to continue the work on this Washington Territory road. The citizens of Seattle subscribed $250,000 toward the work. A large force of graders is to be put on at once to work from Seattle north toward the boundary, and grading will also be resumed on the division running from Spokane Falls west into the Big Bend country, on which 45 miles were built last year.

Redondo Beach.—This road is under construction from Los Angeles, Cal., to Redondo Beach, 20 miles, and 8 miles are graded. Contracts for the rails and rolling stock are let, and it is expected to have the road in full operation by July 15. GEO. J. AINSWORTH, of Los Angeles, is President.

Northern Pacific.—Ballasting and surfacing are finished on the Central Washington railway from Spokane Falls to Mondovi, and work on the grading and track laying westward is to go on at once.——On the Gallatin & Butte line in Montana, contractors Green, Keefe & Co. will have 3,000 hands at work within a month.

Oregonian.—According to recent reports from Portland, Ore., the affairs of this road are getting sadly muddled since its lease to the Oregon Ry. & Navigation Co. was declared invalid. ALEXANDER MACKAY, representing the Scotch holders of the company's securities, is negotiating for the sale of the road to the Southern Pacific company, but has thus far been unsuccessful. The employés have not received their wages for some time and threaten to quit work unless their pay is soon forthcomming.

Oregon Pacific.—Work is to be resumed immediately on the extension of this road east. Engineer ECKLESON with a party of surveyors has been at work east of the summit in Cascade range for a fortnight.

Puget Sound & Gray's Harbor.—This road is to run from Kamilchie, on Little Skookum bay, to Montesano, on Gray's Harbor, Wash. Ty., 36 miles. The road has been in operation as a lumber road for some time for a distance of 8 or 10 miles, and is owned by the Port Blakely Mill Co., of Kamilchie. The contract for the completion of the road has just been let, and the entire line is to be in operation by Aug. 1.

Oregon & Washington Territory.—Petitions are in circulation to cause the next Legislature to permit Walla Walla county to issue bonds to the amount of $250,000 in aid of this company. Construction is to begin very soon.

Projects and Surveys.

Montana & Canada.—Engineers have started on the locating surveys of this Montana road. It is expected to complete all the surveys this year but construction will not be commenced before 1890.

Goodyear, Neilsville & Northern.—Incorporated in Wisconsin to build a line of railway from a point on the Chicago, Milwaukee & St Paul R. R., near Goodyear, Jackson county, to Neilsville, Clark county, a distance of 25 miles. Among the incorporators are, DARIUS A. GOODYEAR, WALTER D. MCPHERSON and NEWELL RICHARDSON.

State Line & Denver.—Incorporated in Colorado to build a line of railway from a point on the Utah boundary line in Mesa county to Denver, with branches from the main line to Aspen and Pueblo. Among the incorporators are: DAVID C. DODGE, GEO. B. DODGE, and JOHN T. EVANS.

Wyoming, Salt Lake & California.—It is thought that this road will connect with the Pacific Short Line at the Wyoming boundary, thus obtaining a through line to the East and affording the Short Line a road to Salt Lake City without the heavy cost of construction through Utah.

FOREIGN.

Monterey & Mexican Gulf.—This company's headquarters in this city are at 40 Wall Street. Gen. GERONIMO TREVINO is President; T. S. BULLOCK (also President of the Prescott & Arizona Central Ry.) is Vice President and General Manager; T. A. WILDER is Secretary and Treasurer. President TREVINO has secured a renewal of the Telfener charter, permitting an extension of the road from Matamoros to the City of Mexico.

Sonora, Sinaloa & Chihuahua.—This Mexican enterprise is being prosecuted under the concession granted to LUIS HULLER and others. Grading is in progress from a point on the Sonora railway 6 miles north of Guaymas, east at the rate of 5 miles per week, and tracklaying is to begin very soon. Grading is also in progress from Chihuahua west.

Bulgaria.—The Government has begun work on the line which is to run from Burghas to Jamboli, 108 kilometres, and will finish it before the close of the year. The work is done by making requisitions for labor upon the peasants in the districts penetrated. Detachments of soldiers are also employed in the work. Important harbor works are planned at Burghas and Varna at an estimated cost of 6,000,000 francs. Another projected line will run toward Shomula and Kaspidian.

RAPID TRANSIT.

Cable Railway.—***Seattle, Wash. Ty.***—The Queen City Street Ry. Co., capital stock, $72,000, will build a cable line 3 miles long on Madison St.

Elevated Railways.—***Boston, Mass.***—The first elevated railway bill having been defeated in the State Legislature, the Street Railway Committee of the Legislature has reported a new bill to the House, to authorize the construction of elevated railways in Boston and the vicinity.

Dummy Lines.—***St. Paul, Minn.***—A dummy line to the summer resort at White Bear Beach is projected.

Concord, N. C.—The Concord Ry. Co. has awarded the contract for grading and tracklaying to E. Fisher and E. Hall.

Clarksville, Tenn.—A dummy line is to be built by JOHN F. SHELTON.

Cedartown, Ga.—It is proposed to build a line 9 miles long, to Cave Springs.

Denison, Tex.—Wm. Bradburn has the contract for grading the new line and has commenced work.

Electric Railways.—***Pittsfield, Mass.***—The street railway company proposes to adopt the Thomson-Houston overhead wire system.

Philadelphia, Pa.—Six storage battery cars are to be put on a line 3 miles long to run to Fairmount Park.

McKeesport, Pa.—The Dravosburg, Reynoldton & McKeesport Passenger Ry. Co. has been organized to build an electric road to connect these places when the new Monongahela river bridges are built.

Omaha, Neb.—The Omaha Street Ry. Co. let a contract May 18 for the equipment of its city lines with an overhead wire electric system at a cost of $250,000.

Spokane Falls, W. T.—The Ross Park Electric Street Ry. Co. has been incorporated. The line will be 4 miles long, and equipped with 6 cars. The Thomson-Houston system will be used. The road will be completed by August. President, G. B. DENNIS; Secretary, C. L. MARSHALL; General Manager, H. N. BELT.

Street Railways.—***New Rochelle, N. Y.***—Surveys are being made for street railways on several streets.

Syracuse, N. Y.—The People's Railway Co. has been granted a franchise for a double track extension of its line.

Philadelphia, Pa.—The Citizens' North Philadelphia Street Ry. Co. and the Citizens' South Philadelphia Street Ry. Co. have been organized in the interest of the Citizens' Street Ry. Co. Capital stock, $36,000 and $30,000 respectively. President, JOHN H. SLOAN.——The Point Breeze Street Ry. Co. has been incorporated to build a line 6 miles long. WM. H. BROOKS is one of the stockholders. Capital stock, $72,000.——The Enterprise Street Ry. Co. has been incorporated to build about 15 miles of track. President, GEO. W. BOILEAU. Capital stock, $500,000.——Charters have been granted to the following companies, in all of which THOMAS C. BARR is interested: Chelton Ave. Passenger Ry. Co., $39,000; Fairhill Passenger Ry. Co., $9,000; Central Passenger Ry. Co., $15,000; Montgomery Ave. & Berks St. Passenger Ry. Co., $21,000; Southwestern Passenger Ry. Co., $36,000.

Pittsburg, Pa.—The Pittsburg & Knoxville Street Ry. Co. has been incorporated to build a line 2 miles long. President, J. H. MCROBERTS. Capital stock, $12,000.

Detroit, Mich.—There is talk of the Board of Public Works building a street railway on Belle Isle. M. CAMPBELL is Secretary.

Marinette, Wis.—A franchise for a street railway 1½ miles long, to Minneconne, has been granted to THOMAS and HENRY HIGGINS, of Neenah, Wis.

Warrensburg, Mo.—The Electric Spring Ry. Co. has been granted a franchise for a street railway.

Perry, Ia.—A street railway is projected.

Sioux City, Ia.—A street railway franchise has been granted to W. R. SMITH, T. C. PRESCOTT, and ROBT. HUNTER.

Liberty, Kan.—A street railway franchise for 50 years has been granted to W. M. BURRIS and others.

Plattsmouth, Neb.—A street railway is projected.

Trinidad, Col.—The Trinidad Street Ry. Co. has commenced grading its line.

Fort Worth, Tex.—The Sylvania Street Ry. Co. has been organized to build a line to Sylvania.

CONTRACTING.

Pumping Engines.—The following proposals for a duplex pump with two 20-in. steam cylinders, 14-in. water cylinders, 18-in. stroke, with a capacity of 2,000 galls. per minute, at the County Building, have been received by WM. H. BREW, County Auditor, Cleveland, O.; Chafer & Becker, Cleveland, $1,850, or $1,675 for a Hughes pump; WM. Bingham Co., Cleveland, O., $1,557.80; Hughes Steam Pump Co., Cleveland, $1,690; Deane Steam Pump Co., Holyoke, Mass., $1,800; Barr Pumping Engine Co., Philadelphia, $1,820; S. J. Cope & Co., Chicago, $2,050; Bowler & Co., Cleveland, $2,075 for Knowles, or $2,775 for Blake pump; Buffalo Steam Pump Co., Buffalo, N. Y., $2,200. The contract was awarded to Chafer & Becker at $1,675 for a Hughes pump.

Flush Tanks.—The following proposals have been received by MICHAEL KEATING, Secretary of the Sewer Commissioners, Green Island, N. Y.: Hawley & Wallace, Schenectady, N. Y., $25 for 6-in. and $35 for 8-in., placed in tank; Benjamin Van Vranken, Schenectady, N. Y., $35; Chicago Flush Tank Co., Chicago, Ill., $35 f. o. b. Chicago, or $40 delivered and placed in tank. No award was made, the Commission deciding to test all 8-in. apparatus furnished by the bidders, as they consider this size suitable for the system. An 8-in. apparatus has been furnished by Hawley & Wallace, which firm has had a 6-in. tank working satisfactorily since October last.

Valves.—The contract for valves for the new pipe line at Washington, D. C., has been awarded by the Washington aqueduct authorities to the Eddy Valve Co., of Waterford, N. Y. There will be 6 48-in., 3 36-in., 3 30-in. and a number of 24, 20, 12 and 6-in. valves; the large valves will all be geared and the 30, 36 and 48-in. will have by-passes. This is one of the largest contracts for large valves that has been given out for several years.

Enameled Bricks.—The following proposals for enameled bricks for the new Congressional Library have been received by BERNARD R. GREEN, Superintendent and Engineer, 145 E. Capitol St., Washington, D. C.: Jas. H. McGill: $82.56 per M. for single-faced stretchers, $92.48 for corner bricks, $102.54 for double-faced stretchers, customs duty included, or $74.98, $83.38 and $91.54 with customs duty excluded. John S. Bullock: $84.90, $95.33 and $140; or $76.10, $86.23 and $128. Howard Fleming: $84.24, $94.75 and $122.50; or $76, $86.13 and $112.75. Barber & Ross: $90, $101.60 and $123.96; or $81.75, $92 and $112.75. M. Rutteman: $92.40, $101.81 and $111.21; or $84.55, $92.40 and $100.25. The contract was awarded to Jas. H. McGill.

Sewers.—The following proposals for sewers at Greensburg, Pa., were opened May 20 by CYRUS T. LONG, Borough Engineer. There are to be 3,100 ft. of 24-in. pipe, 5,500 ft. of 12-in., 22,000 ft. of 10-in., and 3,300 ft. of 8-in.; also 25 manholes. The bids for pipe alone were for straight pipe only. No award was made, as legal objections are being interposed to prevent the borough from issuing bonds. Bids for pipe were as follows: Garrison, Williams & Co., Uhrichsville, O., 75 per cent. discount from card rates, $7 634.75; National Cement Co., 74 per cent., $7,939.10; Taylor & Bullock, Pittsburg, Pa., 73 per cent., $8,244.45; Huston Bros., Pittsburg, 72½ per cent., $8,397.12½; N. U. Walker Clay Co., Pittsburg, 98, 27, 21 and 14½ cts. per ft. for 24, 12, 10 and 8-in. pipe $9,601.50. The other bids are given in the following table.

Bidders.	*Manholes, each.*	*Furnishing and laying pipe including in some cases excavation and filling.*				*Excavation and filling.*				*Total.*
		24-in.	12-in.	10-in.	8-in.	*Under 3½ ft.*	*3½ & under 5 ft.*	*5 & under 7 ft.*	*7 & under 10 ft.*	
Bonnett & Talbott, Greensburg, Pa	$18.00	1.65	0.77	0.68	.63					$26,839.00
" " " "						.40	.40	.45	1.00	15,255.00
The Singley & Boyd Co., Uniontown, Pa	25.00	2.23	0.84½	0.70	.59					29,532.50
" " " "						.36	.40	.55	0.77	18,645.00
E. M. Callaghin, Steubenville, O	40.00	1.98½	0.78	0.74	.70					30,033.50
Bonnett & Eisaman, Greensburg, Pa	19.00	1.78	1.29	0.95	.79					36,595.00
" " " "						.35	.40	.45	0.95	15,255.00
Ott Bros., Pittsburg, Pa	24.00	0.89	0.25	0.19	.13½	.25	.50	.65	0.85	31,394.50
Chas. M. Driver, Pittsburg, Pa	20.00	1.78	1.28	1.23	.80					42,658.00
Rockford Construction Co., Rockford, Ill.	35.00	1.85	0.51¼	0.40	.27	.15	.17½	.22½	0.33	26,747.25
Sloan & McIlvain, Pittsburg, Pa	25.00	1.38	0.73	0.68	.63					25,957.00
C. H. Connell, East Liverpool, O	24.00	1.66¼	0.62¼	0.41¼	.32¼	.23	.32	.45	0.62	34,571.75
McMillon & Moorhead, New Castle, Pa	35.00	1.14	0.55	0.50	.44					19,886.00
McCormick & Moran, Pittsburg, Pa	28.50	1.90	0.80	0.65	.60					27,282.50
H. F. Oinhausen	24.30	0.78	0.21	0.16	.11	.25	.35	.65	0.85	30,096.50
Hastings & Caldwell, Indiana, Pa	30.00	1.57 7/10	0.53	0.40⅝	.28 3/10	.22	.39¾	.527	1.00	36,281.60

Reservoir.—The following bids were opened May 21 by the Water Commissioners, Buffalo, N. N., for the Dodge Farm reservoir:

O'Brien & Clark	$334,502.30
D. F. Minehan	335,081.50
J. D. Yeomans & Co	365,205.41
John Hickler	375,129.91
Charles E. Williams	383,644.40
James Boland	400,698.96
Peter Hickler & Co	417,751.39
P. B. McNaughton	426,105.45
Charles E. Berrick	444,413.11
T. C. Brook	502,917.99
John Druar	578,944.55

The prices of the highest and lowest bids are given as follows:

	Highest.	Lowest.
453,833 yds. earth exc. put in embkts.	$ 0.79	$0.30
75,800 yds. clay in embkts	1.50	0.40
6,104 yds. masonry	10.39	5.98
4,146 ft. stone coping	5.44	2.75
44,471 yds. brick paving	1.25	0.40
28,562 yds. gravel and sand	1.50	0.16
32,156 yds. 8-in. stone paving	3.00	1.50
3,430 ft. curbing, 6 in.	0.78	0.49
Stairway and house	9,385.00	2,800.00
27,405 yds. soiling and seeding	0.30	0.14
3,685 ft. gravel walk	0.60	0.06
768 yds. concrete	8.00	3.95

Street Work.—***Albany, N. Y.***—The contract for paving Lark St. has been awarded to Jacob Holler, as follows: granite blocks, $2.73 per sq. yd.; curb, 77 cts. per lin. ft. for straight and 89 cts. for circular; relaying old curb, 18 cts. per lin. ft.; crosswalks, 7 cts. per sq. ft.; relaying granite, 47 cts. per sq. yd.; track excavation, 5 cts. per lin. ft.

Buffalo, N. Y.—The Barber asphalt paving is to be laid on a part of Waverly Ave.

Wellsburg, W. Va.—The new Board of Public Works has decided to put in macadam and brick paving.

Atlanta, Ga.—The Street Committee has awarded a contract to O'Neil & Waters, at 16½ cts. per cu. yd., for earth excavation, 22½ cts. for loose rock, and 69 cts. for solid rock.

Seattle, Wash. Ty.—Contracts have been awarded at the following prices: W. N. White: 25 cts. for earthwork, $18 for cribbing, $17 for sidewalks, and $17 for drains. Thomas McMullen: 29½ cts., $15, $15.75, and $15.75. M. O'Brien: 27 cts., $18, $15.

Oakland, Cal.—A contract for $25,000 or $30,000 for bituminous rock paving on Broadway has been let.

London, Ont.—City Engineer TRACY has prepared estimates for street work, the aggregate cost of which will be $17,000.

Tunnel and Shafts.—Shailer & Schniglau, engineers and contractors, Chicago, Ill., have been awarded the contract for building the water tunnel, shore and lake shafts, crib, light house and electric machinery for the city of Lake View, Ill. The tunnel is to be 6 ft. in diameter and to extend under Lake Michigan 5,000 ft. The contract price is $159,650 and work is to be commenced at once.

Sluice Gates.—The following proposals for 16 3 x 6 ft. sluice gates, with the necessary lifting machinery, at the new gate house on section No. 1 of the new Croton aqueduct have been received by the Aqueduct Commissioners, New York City: JOHN FOX, $21,900; Caldwell, Wilcox & Co., $23,440.

Water-Works Extensions.—The Board of Public Improvements, St. Louis, Mo., has awarded the contracts for Sections B and E of the low-service conduit to Allen & Vieths at $98,992.80 and $164,369 respectively. The work on Section B consists of 44,000 cu. yds. of embankment, 4,000 cu. yds. of soil dressing, 300 cu. yds. of riprap, 14,000 sq. ft of Telford pavement, 6,800 cu. yds. of concrete, 4,200 yds. of brick masonry, 45,000 sq. ft. of granitoid, 730 sq. ft. of gutter paving and 200 lin. ft. of 12-in. pipe culvert. On Section E the quantities are as follows: 36,000 cu. yds. embankment; 3,700 cu. yds. soil dressing; 10,000 sq. ft. Telford pavement; 12,300 cu. yds. concrete; 64,800 sq. ft. granitoid; 7,400 cu. yds. brick masonry; 28 cu. yds. stone masonry, class X; 150 cu. yds. stone masonry, class Y; 170 lin. ft. 15-in. clay pipe culvert; 50 lin. ft. 12-in.; 260 lin. ft. 20-in.; 6,000 ft. M. B. lumber in chamber; 100,000 ft. M. B. lumber left in place.

Broken Stone.—The following proposals have been received by the Village Trustees, South Orange, N. J.: D. O. Meeker, $1.75 per ton; J. H. Marshall, $1.73; Spottiswood & Co., $1.69; C. A. Lighthope, $1.68.

PROPOSALS OPEN.

Water-Works.—System of water-works. Also inclined street railway, Chattanooga Water & Power Co., Chattanooga, Tenn.

Bridge.—Over the Mississippi. THE COUNTY BOARD, Aitkin, Minn. June 5.

Sewer Pipe.—For 1 year. H. L. WILSON, Atlanta, Ga. June 5.

Asphalt Paving.—Trinidad asphalt. THE CITY CLERK, Oneonta, N. Y. June 5.

Building and Jail.—Plans and specifications invited. Cost not to exceed $20,000 and $10,000. N. A. CRAVENS, Jr., County Judge, Conroe, Tex. June 10.

Street Work.—GEO. R. BRINGHURST, City Secretary, Houston, Tex. June 10.

New Croton Aqueduct.—Constructing roads. Also furnishing 9 3 x 4 ft. double stem sluice gates, with lifting machinery; and 22 2 x 5 ft. sluice gates, with lifting machinery. JAMES C. DUANE, President, Aqueduct Commissioners, 280 Broadway, New York City. June 12.

Bridge.—Built of lumber; 100 ft. long and 12 ft. wide. D. B. SANFORD, Milledgeville, Ga. June 15.

Paving Material.—About 30,000 tons of granite blocks; 10,000 lin. ft. of granite curbing; 50,000 lin. ft. of granite flagging for gutters. CHARLES D. JACOB, Mayor, Louisville, Ky. June 15.

Sewers.—At Clifton, O. A. S. HOBBY, C. E., 227 Main St., Cincinnati, O. June 15.

Stone.—About 3,334 cu. yds. of stone for repairs of draw pier of Rock Id. bridge. Major J. R. MCGINNISS, U. S. A., Rock Island, Ill. June 20.

Trenching.—Trenching, about 38,000 cu. yds. Also furnishing lead, jute packing and patent pointers. Col. JOHN M. WILSON, U. S. A., office of the Washington Aqueduct, Washington, D. C. June 20.

Pump and Boiler.—Davidson No. 8½ pump and 2 boilers. T. WILLIAMSON, Chief Engineer, U. S. N., Supt. of State Dept. Building, Washington, D. C. June 21.

Bridge.—Iron bridge over Yalobusha river. J. T. THOMAS, Grenada, Miss. July 1.

MANUFACTURING AND TECHNICAL.

Sewer Pipe Works.—The Lookout Sewer Pipe Co. has been organized at Chattanooga, Tenn., by J. G. RAWLINGS, M. A. WOODBURN and E. P. DURANDO, of Chattanooga, and F. G. BENNET, JOHN I. SMITH and W. A. RICHARDS, of Jackson, Mich. Capital stock, $80,000.

The Seattle Sewer Pipe & Fire Brick Co. has been incorporated at Seattle, Wash. Ty., by R. C. WASHBURN, R. H. BOYLE and JOHN CAMPBELL. Capital stock, $50,000.

The Beatrice Sewer Pipe & Brick Co. has been incorporated at Beatrice, Neb., with a capital stock of $250,000.

Railway Supplies.—The Chicago Street & Steam Railway Supply Co. has been organized at Chicago, Ill., by JAMES A. ANDERSON, JOHN E. WAUGH and M. W. BLISS. Capital stock, $50,000.

Basic Steel.—The Henderson Steel & Mfg. Co. is reported as intending to establish works at Birmingham, Ala., for the manufacture of steel by the basic process. The Elyton Land Co., of Birmingham, is also said to be interested in a basic steel project.

Pole Road.—The Richmond Red Cedar Works are building a pole road 13 miles long at Forest, Ala., and have purchased a locomotive from the Richmond Pole Road Locomotive Co., of Richmond, Va.

Signals.—The European Railway Signal Co. has been organized at Richmond, Va., by W. J. JOHNSON, C. L. COOK, and H. L. HOOVER, for the manufacture of electric signals.

The Illinois-Missouri Construction Co. has been organized at Chicago, Ill., by L. C. TWOMBLEY, JOHN W. DYER, and JOSEPH LATHROP. Capital stock, $500,000. The company proposes to build railways, bridges, etc.

Rails.—The Allegheny Bessemer Steel Co., of Allegheny, Pa., has taken an order for 11,000 tons of steel rails for an Alabama road at $26.50 per ton.

Garbage Cremation.—At Macon, Ga., the City Council has referred to the finance committee the matter of purchasing a garbage crematory.

At St. Augustine, Fla., the City Council is thinking of contracting with the Engel Crematory Co. for the erection of a garbage crematory.

Culverts.—The Lake Erie & Western Ry., and the Chicago & Eastern Illinois Ry., are substituting pipe culverts for the old wooden culverts.

Asphalt Works.—Works for the manufacture of asphalt paving blocks are to be established at Macon, Ga., by GEO. F. WORK.

Creosoting Works.—The Carolina Oil & Creosote Co. of Wilmington, N. C., has been reorganized. President, WARNER MILLER; Superintendent, Capt. A. A. THOMAS.

Boilers.—The Babcock & Wilcox Co., of New York, has an order from the Pennsylvania Steel Co. for a battery of its patent water-tube boilers, with an aggregate of 4,000 H. P.

Paving Brick.—The Peoria Paving Block Co. has been organized at Peoria, Ill., by SAMUEL KINSEY, VALENTINE JOBST, and WM. WHITE, to manufacture paving blocks, sidewalk paving tile, and brick. Capital stock, $25,000.

Switch.—The National Switch & Signal Co. is arranging to manufacture its patent switch at South Easton, Pa. W. A. WILBUR, of South Bethlehem; W. F. PASCO, of South Easton, and R. CAFFREY, of White Haven, are directors. The Lehigh Valley has a trial switch in use, and will put in two more.

Locomotives.—The Portland Co., of Portland, Me., is building 2 engines for the Maine Central.

The Manchester Locomotive Works, of Manchester, N. H., have an order for 3 engines for the Concord road.

The Rhode Island Locomotive Works, of Providence, R. I., have shipped 2 new freight engines to the Savannah, Americus & Montgomery.

The New York Locomotive Works, of Rome, N. Y., have an order for 4 eight-wheel passenger engines for the Mobile & Ohio, and have turned out 2 passenger engines for the Rome, Watertown & Ogdensburg.

A locomotive is wanted by W. O. WADLEY, of Rogers, Ga., for the Rogers & Summit road.

Fencing.—The Washburn & Moen Mfg. Co., of Worcester, Mass., has the contract for fencing the Poughkeepsie & Connecticut Ry., a part of the Poughkeepsie bridge system, from Poughkeepsie to Silvernails. Also for fencing the New York extension of the Baltimore & Ohio from Roselle to the Arthur Kill bridge.

Brake.—The Widdifield & Bowman Electric Brake Co. has opened a temporary office at 125 Temple Court, New York City.

The Niles Tool Co., of Dayton, O., has opened an office at 98 Liberty St., New York City.

The Ingersoll-Sergeant Rock Drill Co., of New York, has recently made foreign shipments of complete mining plants to South Africa and Japan. The company has a large exhibit of rock drills, air compressors, channeling machines, etc., at the Paris exposition.

Cars.—The St. Charles Car Co., of St. Charles, Mo., has delivered 2 chair cars to the Toledo, Ann Arbor & Northern Michigan.

The Terre Haute Car Works, of Terre Haute, Ind., have turned out 40 of Street's stable cars.

The Lima Car Works of Lima, O., have an order for 25 refrigerator cars for the Ohio & Mississippi.

The Litchfield Car Works, of Litchfield, Mo., are building 18 passenger cars for the Union Pacific; also 150 fruit cars, 50 box cars and 50 refrigerator cars for the Belleville & Southern Illinois.

The Pullman Palace Car Co., of Pullman, Ill., has sent 2 elaborate cars out to the motor line at Helena, Mont. An order is on hand for 8 cars for the Kansas City & Independence road.

Pile Work.—The following proposals for 2,400 ft. of pile and revetment work at Dry Stocking bar, Tillamook bay, Oregon, were opened May 15 by Capt. W. YOUNG U. S. Engineer Office, Portland, Ore.: R. L. Hall, $2 per ft., $4,800; J. C. Mason, $3,700 for 1,800 ft. or $4,933.33 for 2,400 ft. The amount available is only about $3,700.

Dredging.—The following bid for dredging in Apalachicola bay, Florida, was the only one received May 16 by Capt. PHILIP M. RICE, U. S. Engineer Office, Montgomery, Ala.: Alabama Dredging & Jetty Co., Mobile, Ala., 24¾ cts. per cu. yd.

BRIDGES AND CANALS.

Bridge Notes.—*Bangor, Me.*—The contract for the eastern span of the Kenduskeag bridge has been awarded to the Groton Bridge Co., of Groton, N. Y., at $2,350. The bids were as follows: Groton Bridge Co., $2,350, $3,495; Berlin Bridge Co., East Berlin, Conn., $3,913, $4,472 $4,653; J. E. Buddington, $4,114; Hinckley & Egery Iron, Co., $4,175; Wrought Iron Bridge Co., $4,386, $4,481; King Iron Bridge & Mfg. Co., $4,849; Vermont Construction Co., $5,176.77.

Great Barrington, Mass.—The Berlin Bridge Co., of East Berlin, Conn., has a contract for an iron bridge to cross the Williams river.

Holyoke, Mass.—All bids for the Connecticut river bridge substructure which were opened May 13 by the County Commissioners at Springfield, were rejected. Afterwards a contract was made with Wright & Lyons for extending the piers and abutments with granite at $22.50 per cu. yd.; the contractors to do all excavations for foundations, pumping, etc., and to build the grillage.

Gowanda.—The contract for the new iron bridge has been awarded to the Groton Bridge Co., of Groton, N. Y., for $7,796.

Rochester, N. Y.—The Smith St. lift bridge, built by the Rochester Bridge & Iron Works, has been accepted. It is 110 ft. long and 19 ft. wide, with two 6-ft. sidewalks.

Philadelphia, Pa.—The Philadelphia & Reading Ry. bridge over the Schuylkill near Manayunk will be built by the Pencoyd Iron Works.

Annapolis, Md.—Mr. J. M. HOOD, President of the Western Maryland Railway, has submitted to the Board of Public Works the plan of the proposed bridge to be constructed by the Western Maryland Tidewater Railway Co. across the middle or Spring Gardens branch of the Patapsco river.

Ty Ty, Ga.—W. R. Glover has a $3,080 contract for a bridge across the Alapaha river.

Springwells, Mich.—An iron drawbridge is to be built across the Rouge river at a cost of $20,000.

Topeka, Kan.—The City Engineer is preparing plans of a highway bridge to cost $225,000.

Clinton, Ill.—The Chicago & Eastern Illinois Ry. has contracted for an iron bridge across the Wabash.

East St. Louis, Ill.—The Committee on Bridges has recommended the reconstruction of the Missouri avenue bridge near the Relay depot. A committee was appointed, consisting of Mayor Stephens and the Chairman of the Bridge Committee, to confer with the water-works company and gas company and ascertain what arrangements they will make toward paying part of the cost of reconstruction. The companies are benefited by using the girders of the structure as supports for carrying their mains over Cahokia creek.

Alma, Neb.—A contract has been let for an iron bridge across the Republican river to cost $4,000.

Lincoln, Neb.—The contract for all iron bridges to be built during the year has been awarded by O. C. BELL, County Clerk, to the Geo. E. King Bridge Co., of Des Moines, Ia., and for all pile and combination bridges to C. D. Dundas, of Pawnee City, Neb.

San Luis Obispo, Cal.—The San Francisco Bridge Co. has a contract for a bridge to cost $2,076.

Rockwell, Tex.—A company has been organized to build a bridge and trestle across East Fork slough. Length, 3 miles. Cost, $10,000.

Paris, Tex.—The Paris, Choctaw & Little Rock Ry. Co. will build a bridge across Red river. S. J. WRIGHT is President.

Chambly, Que.—An iron bridge is to be built in the parish of St. Joseph de Chambly. Bids for 2 stone piers will be opened June 3 by JOSEPH TRUDEAU, Jr.

Dresden, Ont.—The contract for the construction of the new iron bridge at Dresden has been awarded to E. Smith, of Dresden, and Wm. Whitebread, of Wallaceburg. The contract price is about $17,000.

Coteau, Que.—The Canada Atlantic Ry. Co. has decided to place some 300 workmen on the work of constructing the new bridge over the St. Lawrence river at Coteau. The company expects to run trains over the new bridge next fall. The work will cost over a million dollars.

Richmond & Danville Ry.—The King Iron Bridge & Mfg. Co., of Cleveland, O., has a contract for 11 spans of iron bridges.

Pontoon Bridges.—*Sioux City, Ia.*—The new pontoon bridge across the Missouri was opened May 18. It is carried on wooden boats 18 ft. by 16 ft, anchored to wire cables and rocks. It cost about $40,000. There is a draw for river traffic.

Yankton, Dak.—A franchise for a pontoon bridge has been granted to GEO. A. MEED, of Sioux City, Ia., and surveys are being made.

Leavenworth, Kan.—An ordinance has been passed authorizing the construction of a pontoon bridge. Mr. STILLINGS is interested in the project.

Harbor.—A bill has been passed by the New York State Legislature appropriating $21,000 for the improvement of the harbor at the foot of Canandaigua creek.

Viaduct.—*Los Angeles, Cal.*—The construction of the 1st St. viaduct, which is to carry the street and the cable railway across the Santa Fé tracks, having been delayed by the refusal of one of the property owners to accept the arbitrators' award, the Council has instructed the City Attorney to ring the case at once before the court for decision.

Indianapolis, Ind.—The contract for the iron girder-work over Pogue's run for the Union Railway Co., has been awarded to the Massillon Bridge Co., their bid being $6,542.60. The other bids were as follows: Penn Bridge Co., $6,675; Columbia Bridge Co., $6,730; Canton Bridge Co., $7,000; Haugh, Ketcham & Co., $7,435.42; King Bridge Co., $7,680; Edge Moor Bridge Works, $8,244

Wheeling, W. Va.—Mr. T. L. HOGE, engineer to the Board of Public Works, has presented the following estimate of the cost of a proposed stone bridge over the creek at Main St., said bridge to be an elliptical arch of 150 ft. span, 35 ft. rise and 40 ft. wide: Abutments (2) 2,037 cu. yds. at $10, $20,870; backing and sides, 2,322 cu. yds. at $4, $9,288; arch, 1,199 cu. yds. at $20, $23,980; parapet and coping, 214 cu. yds. at $10, $2,140; curbs and sidewalks, $649; brick paving 948 sq. yds. at $1.05, $1,280; wing walls (4) 3,093 cu. yds. at $8, $24,744; total cost for 40-ft. wide bridge, $82,451. The same bridge 44 ft. wide will cost $87,943; 35 ft. wide, $75,592; 42 ft. wide, $85,197.

ELECTRICAL.

Electric Lighting.—***Middleboro, Mass.***—The Middleboro Electric Light & Power Co. and the Middleboro Gas & Electric Co., both claim the right to erect poles and wires, and the case has been referred to the State Gas Commissioners.

Portchester, N. Y.—The gas company will put in an electric light plant.

Waterloo, N. Y.—It is proposed to operate the electric light system in connection with the water-works plant, and the two companies may be consolidated. The Edison plant is being put in.

Washington C. H., O.—The members of the Washington Gas Light Co. have organized an electric light company and are now putting in the Thomson-Houston system; there will be 20 street lights at first, and the number will be increased afterwards. Residences will be lighted by the same plant.

Columbus, O.—When the electric lights were first introduced the company agreed to operate 50 lights at a cost of $50 per annum. This offer was made to induce the city to give the lights a trial, and it was understood that the city should pay $80 per year for all additional lights. Each electric light displaces about 5 gasoline lamps, for which the city pays $15.50 each per annum. Thus the cost of electric lights is not much greater than the cost of gasoline lamps.

Cairo, Ill.—The Cairo Electric Light & Power Co. has increased its capital stock from $10,000 to $25,000.

Pana, Ill.—It is proposed to put in an Edison system of electric lighting.

Bloomington, Ill.—An electric light company has been organized, and has applied for a franchise. President, DUNCAN M. FUNK; Secretary, HENRY CAPEN; Treasurer, WILLARD PARRETT.

Sioux City, Ia.—The Council, after investigation, has concluded that the city can operate an electric light plant of its own cheaper than by contracting with a company, and will probably supply a system of lighting during the present year. A plant of sufficient capacity for that city can be purchased for $35,000.

Mitchell, Dak.—A Minneapolis company has been granted an electric light franchise.

Monte Vista, Col.—The Monte Vista Electric & Gas Light Co. has been incorporated by ROBT. B. WALLACE, ORLANDO BONNER, and WM. A. HOYT. Capital stock, $25,000.

Three Rivers, Que.—A proposition has been made to the Council by a syndicate headed by GEO. MCDOUGALL and A. J. CORRIVEAU, to supply arc lights for street lighting, about 2,000 or 3,000 incandescent lights for domestic use, and to supply the city with electric power to run the water-works, and also to run factories or for other purposes. The lights and power would be transmitted by electricity from a water power capable of supplying 10,000 to 15,000 H. P., if needed, but situated on the St. Maurice river, 16 miles from the city of Three Rivers. This is, it is believed, the longest distance yet that electric power and light is to be transmitted.

Springfield, Mass.—The electric light contract for furnishing 300 or more lights to the city at $83.33⅓ a year per light has been finally signed by the street lighting committee and the United Electric Light Co. The contract provides that the electric light company shall furnish for five years from May 22, 300 electric lamps of the kind known as "half-arc lamps," or 1,200 standard c. p. lights, and also furnish all the poles, apparatus, fixtures, and accessories except the lamp poles, properly equipped for the lamps, which are to be furnished by the city. The company is to operate and maintain the lights within a radius of 1½ miles of City Hall, but extending to the Chicopee town line on Main street and at such locations as the city council may direct. The company's new plant is nearly completed, and will be very extensive, including a Corliss engine, 3 Hazleton boilers, and a number of dynamos.

Water Power for Electric Plant.—The Illinois Valley Electric Light & Power Co., which has been incorporated at Ottawa, Ill., intends to operate incandescent electric lights in the cities of Ottawa, Marseilles and Seneca. All of these are located on the Illinois river, the former 8 miles below and the latter 5 miles above Marseilles. The principal lighting is to be in Ottawa, but as the water power privileges at this place are controlled by rival companies, it became necessary to look elsewhere for a location for the plant. The next best point is Marseilles, there being an unlimited amount of water power available at that place. In order to operate the plant successfully at this distance, however, it became necessary to adopt a system which is not affected by distance. After some months of investigation, it was found that the Heisler system answered every purpose, and a contract was accordingly closed with the Heisler Electric Light Co., of St. Louis, Mo. The plant now being installed has a capacity of about 700 lights of 30 c. p., but it is expected that it will be necessary to increase this capacity to 2,000 lights in order to supply the demands for public, commercial and domestic lighting in the three cities. Ottawa is located near the center of LaSalle County, and Seneca is near the county line, 13 miles away.

WATER AND MUNICIPAL.

New Croton Aqueduct.—The Aqueduct Commissioners have closed the hearing concerning the dam and reservoir at Purdy's Station, and approved the plans proposed by Chief Engineer FTELEY.

Filter Plant.—The Elyton Land Co., of Birmingham, Ala., which is building water-works, will put in a large filter plant.

The Water Committee, Philadelphia, Pa., has received a proposition from the National Sewerage & Sewage Utilization Co. to build iron elevated filter beds over and above each reservoir or basin to furnish pure water. The representatives of the company propose to build structures for the purpose costing about $2,000,000 and to receive each year for 30 years $300,000 from the city.

Water Power.—At Winnipeg, Man., the Council has been considering whether to undertake the work of developing the water-power, or to let the new water-power company do the work. Mr. RUTTAN, the engineer, stated that the cost would be about $300,000 for a dam and main water-way, or $450,000 with a lock; but as Mr. PERLEY, the Government engineer, has stated that the Assiniboine is not navigable, the Government may not require the construction of the lock. It was finally decided to take a public vote on the proposition to issue $400,000 for this purpose.

Watertown, Dak.—The water question has been settled. Under the original contract the city was to pay $5,000 per year for 80 hydrants, with 5 miles of mains within the city limits, and each mile of mains additional was to cost $48 per hydrant, with 16 hydrants to the mile. The company then claimed that this amount was too small, and the Council, despite opposition, made a new contract, giving the company $7,600 per annum for 80 hydrants and $75 per year for additional hydrants, at 16 to the mile. A new contract has now been signed, by which the city agrees to pay $6,000 per year and $48 per hydrant additional on all mains hereafter located, with 12 hydrants to the mile.

Drainage.—Calhoun county, Iowa, has undertaken the drainage of 50,000 acres of marsh land at a cost of $35,000.

Artesian Wells.—***Red Bank, N. J.***—The Water Commissioners open bids to-day for two 3-in. wells 250 ft. deep.

Geneva, Ala.—It is proposed to put down a well for a water supply.

Centerville, Ia.—The city has expended $8,000 on a well 2,500 ft. deep, but the water only comes to 250 ft. below the surface.

Huron, Dak.—A vote is to be taken on a proposition to sink an artesian well for a water supply.

Faulkton, Dak.—The artesian well has struck water at a depth of 1,250 ft.

Chamberlain, Dak.—The City Council will invite proposals for putting down an artesian well to supply power for running an electric light plant.

Del Norte, Col.—The city has awarded a contract for 4 wells to the Colorado Tubular Well Co. They will be 2,500 ft. deep if necessary.

Beebe, Ark.—The St. Louis, Iron Mountain & Southern Ry. Co. will put down a well.

Wynne, Ark.—The town authorities are sinking wells with a view to obtaining a water supply.

Marshallville, Ga.—Artesian wells are to be put down by J. O. FARNER. Information is wanted.

Sherman, Tex.—Bids for an artesian well water supply are being invited.

Grant, Neb.—A local company is to be organized to put down artesian wells.

Bridgeton, N. J.—The Water Department has issued its report for 1888. The total pumpage was 99,047,000 galls. There are 16¼ miles of pipe, 149 stop gates, 105 hydrants, and 1,154 attachments. TIMOTHY WOODRUFF is Superintendent.

Toledo, O.—The City Engineer has issued his report for 1888. The paving done was as follows: 2.66 miles of cedar block, .26 mile of Medina stone, and .69 mile of fire brick. About 2½ miles of main sewers and 2 miles of local sewers have been built. Eight artesian wells have been put down, at a cost of $2,595.43. Tables are given of the work done. THOS. R. WICKENDEN is City Engineer.

Richmond, Va.—The Superintendent of Water-Works, C. E. BOLLING, has issued his report for 1888. The total amount of water pumped was 4,142,274,892 galls.; the cost of pumping was $3.56 per million gallons with the new pumps, $5.11 with the old pumps, and $8.53 with the steam pumps. There are only 85 meters in use and Mr. BOLLING repeats his recommendations in favor of their being put into general use. The water waste is very considerable. There was laid during the year 25,091 ft. of pipe, 50 stop valves and 32 hydrants. There are now 70.71 miles of pipe and 475 hydrants.

Plymouth, Mass.—The Water Commissioners have issued their report for 1888. The total amount of water pumped was 97,500,356 galls., with an average dynamic head of 64 ft. During the year 5,531 ft. of pipe were laid and 25 gates set, making an aggregate of 148,993 ft. of pipe and 242 gates. R. W. BAGNELL is Superintendent.

Dover, N. H.—The Water Commissioners have issued their report for 1888, being the first annual report, and a report of progress only, as the works were not finished when it was written. The Board was organized in June, 1888. The reservoir was filled in November. There are 116 hydrants, and the rental is $30 per annum. The water supply is pumped from wells to the reservoir, which is 150 ft. diameter at the bottom, 19 ft. deep, and has a capacity of 2,000,000 galls. The total cost of the works is estimated at $224,426.89. PERCY M. BLAKE was the engineer; WM. D. TAYLOR is Superintendent, and CHAS. A. FAIRBANKS is Clerk.

Allentown, Pa.—The Commissioners have issued their report for 1888. After 9 months service the new Knowles pumping engines are found to be entirely satisfactory. It is said that one of the defects of the system is the quantity of small pipe in use, and this is being remedied gradually. It is recommended that private springs near the city's supply springs should be purchased to increase the suppy. During the year 9,480 ft. of pipe were laid, 1,120 ft. relaid, 50 valves and 10 hydrants set. SAMUEL S. THOMSON is Superintendent.

Artesian Wells in Utah.—A western paper says that the first big artesian well in Utah has been completed on A. H. NELSON'S ranch, northwest of Plain City. The well is sunk to a depth of 450 ft., and throws at present over 30,000 galls. of good water per hour. The machinery used is that imported and owned by Dr. ROCHE, of Lakeside ranch, near Corinne. Considerable excitement has been aroused around this city and Plain City by this successful experiment, and a number of wells have already been contracted for. Dr. ROCHE has sent to Pennsylvania for another machine which will bore down 5,000 ft.

Fresno, Cal.—The new sewers are approaching completion. The pipe is being furnished by the California Sewer Pipe Co., of San Francisco. The sewage will be conveyed to the alkali plains, 6 miles distant, where the wind will not bring offensive odors back to the city. A contract for the use of the sewage has been let for five years to the proprietors of the lands, at the end of which time, if the experiment of thus disposing of the sewage proves unsatisfactory, other arrangements will be made.

Conshohocken, Pa.—For some time past the stockholders of the Conshohocken Electric Light Co. have been quietly buying up the stock in the gas company, which was incorporated in 1874 by Professor LOWE, of Norristown, who established his water-gas system. For a few years the gas company did not make any money, but after a while began paying dividends, and altogether has paid five dividends on the stock, which was capitalized at $50,000. The electric light parties have secured enough of the gas company stock to give them a controlling interest, and at a recent meeting WILLIAM HENRY CRESSON, JONATHAN R. JONES and HENRY M. TRACY were elected to the Board of Managers. The first thing they did was to raise the price of gas per thousand feet from $1.50 to $1.80. The electric light company has elected F. H. LUBY, President; WILLIAM HENRY CRESSON, Vice-President; and DAVID H. ROSS, Secretary. A vote was taken on increasing the capital stock from $20,000 to $50,000 and was carried. The two Conshohocken lighting companies now being controlled by virtually the same parties they will probably be consolidated.

Madison, Wis.—The Board of Public Works has awarded the contract for the new storage reservoir to Timothy McCarthy, of Madison, at $3,493 for labor and material necessary for the construction of a reservoir of 200,000 galls. capacity and covering over the same. The city will furnish asphalt for cement. The reservoir will be circular, 40 ft. diameter, 22 ft. deep, with a 16-in. brick wall having a 1-in. space for cement to be settled 19 or 20 ft. after the wall is laid. E. M. NICHOLS is superintendent of Water-Works.

Teheran, Persia.—The City of Teheran Water-Works Co. has been organized at Bangor, Me., with a capital stock of $1,000,000. President, F. H. CLERGUE; Treasurer, M. H. WARDWELL; Directors, F. H. CLERGUE, F. M. LAUGHTON, M. H. WARDWELL and J. R. MASON.

Sewerage.—***York Beach, Me.***—A company has been organized to build sewers. Surveys were made last fall by Mr. JORDAN, C. E., of Portland, Me.

Orange, Mass.—A sewerage system is projected, and the cost is estimated at $60,000.

Buffalo, N. Y.—The Council has decided to build several sewers; 32, 30 and 24-in. brick and 8, 12 and 18-in. pipe.

New Rochelle, N. Y.—Surveys have been made recently for the proposed sewerage system.

Flatbush, N. Y.—The new Sewer Commissioners have elected HENRY HESTERBERG, President, and JOHN J. BOLLINGER, Secretary.

Reading, Pa—The taxpayers have voted against the proposition to issue $300,000 in bonds for sewer purposes.

Guyton, Ala.—A sewerage system is projected. For particulars address W. B. MELL.

Natchez, Miss.—The Natchez Water & Sewer Co. will put in a system of sewerage. President, J. A. JONES.

Avondale, O.—Sewers are to be built. ARTHUR S. HOBBY, 227 Main St., Cincinnati, is Engineer to the Sewer Commissioners.

Detroit, Mich.—The Legislature has authorized the issue of bonds for $500,000, and about $200,000 will be expended for a sewer in Woodward Ave.

Winona, Minn.—It is proposed to put in a system of sewers similar to that at Pullman, Ill.

Fort Dodge, Ia.—A sewerage system is needed.

Hastings, Neb.—It is proposed to build a system of sewerage at a cost of $200,000.

Yankton, Dak.—Proposals for the construction of sewers have been advertised for.

Butte, Mont.—A sewerage system is projected.

Seattle, W. T.—Mr. G. M. MILLER, Superintendent of Sewers at Helena, Mont., has made a proposition to prepare plans for a sewerage system.

Corsicana, Tex.—The city has accepted the plans and specifications prepared by D. A. POYNER, and wants bids for construction. For particulars address the mayor or city clerk.

Water-Works.—***New Hampshire.***—Littleton. The dam of the upper of the 3 reservoirs of the Littleton Water & Electric Light Co. gave way May 21, owing to the heavy rains. Two bridges were damaged.

Massachusetts.—Attleboro. The Water Commissioners propose to put in an additional pump.——North Brookfield. A committee has been appointed to petition the Legislature for power to put in a water supply.

Connecticut.—Thompsonville. The Thompsonville Water Co. has made a survey for an extension to Warehouse Point.—— Manchester. The Manchester Water Co. has cleaned out its reservoir. Grant & Sisson have the contract for a bridge to carry the water pipes across the Hockanum river.

New York.—Watkins. The Governor has passed the bill to allow the village to contract with any water company organized in this State.——Schenectady. The Water Commissioners have received bids for a compound horizontal, high-duty engine of 5,000,000 galls. daily capacity, and 2 boilers.——Silver Springs. The Castile Water-Works Co. will probably furnish a water supply. ——Greenbush. The water mains are being extended. ——Gloversville, N. Y. The Water Commissioners will receive bids for extensions until June 10. There will be 108 ft. of 40-in. cast-iron pipe, 13,250 ft. of 18-in., 1,155 ft. of 16-in., 935 ft. of 14-in., 1,010 ft. of 12-in., 700 ft. of 10-in., 2,964 ft. of 6-in., 1,898 ft. of 4-in.; 48,000 lbs. of specials, 46 valves, 14 double nozzle hydrants and 41 street valve boxes. Also bids for trenching, pipe laying and constructing one reservoir. J. J. HANSON is President.

New Jersey.—Long Branch. The Long Branch Water Co. acceded to the Commissioners' proposition on May 22, and turned the water on again.——Mt. Holly. The Mt. Holly Water Co. will erect new works further up Rancocas creek, in order to obtain a better water supply. Bids will be opened June 15 for constructing a pumping station, laying 4,700 ft. of 12-in. pipe, etc. HENRY C. RISDON is Secretary.

Pennsylvania.—Bethlehem. The Water Committee has contracted for an iron reservoir 50 x 50 ft., to cost $7,700.

North Carolina.—Goldsboro. The Goldsboro Water Co. has awarded the contract for constructing the works to Porter & Godwin.——New Berne. Major Dennison is extending the works.

Georgia.—Macon. The Macon Water & Gas Co. will put in an additional pump of 5,000,000 galls. capacity.—— Fort Valley. A company has been organized by Capt. JOHN A. HOUSER, H. C. HARRIS and C. G. GRAY, to furnish a water supply. The water is to be pumped from an artesian well to a reservoir.—— Savannah. The cost of the proposed new works is estimated at $120,000.

Alabama.—Spring Garden. The Spring Garden Water-Works & Improvement Co. has been organized to build the new works. President, J. W. TUCKER; Treasurer, W. T. CLARK; Secretary, W. M. GRAHAM.

Mississippi.—Vicksburg. Chief Engineer DELAFELD has arrived from New York, to superintend the repairs and put the works in proper condition again.

Louisiana.—New Orleans. The case in which the taxpayers tried to have the contract made by the city with the New Orleans Water-Works Co. declared illegal and unconstitutional, has been decided by the Supreme Court in favor of the company.

Tennessee.—Johnson City. The granting of a contract for water-works has been postponed, but it is hoped to put in works this summer. S. SIMCOX is Chairman of the Water-Works Committee.——Columbia. A water-works franchise has been granted to a local company. President, F. EWING.—— Pulaski. A vote will be taken June 15 on the proposition to issue bonds for water-works.

Kentucky.—Central City.—The Central City Water Co. has made a proposition to build water-works.—— Princeton. Water-works are to be built.—— Stanford. A local company is to be organized to build water-works. ——Richmond. The Richmond Water-Works Co. has turned the franchise over to the city on condition that the city pay the expenses of same, and begin the erection of works within 3 months.

Ohio.—Wilmington. Water-works are projected, and a committee has inspected the works at Xenia.

Indiana.—Brazil. The newly elected water-works trustees have resigned, owing to the Council having fixed the salary at only $25 per annum.

Michigan.—Albion. The vote taken May 20 on the issue of $50,000 bonds for water-works resulted in a favorable majority of 105.——Grand Haven. A vote was taken May 22 on the issue of $25,000 for extending the works.——St. Ignace. The Water Commissioners will receive bids until June 12 for building a complete system of works in accordance with specifications on file.

Illinois.—Buckley. Water-works are projected.—— Carlinville. Garis & Loomis have the contract for pipe-laying.

Iowa.—Cherokee. The contract for the construction of the water-works has been let to E. A. Sykes, of Minneapolis, Minn., at $20,875.——Sioux City. Bids for furnishing and laying the independent main from the reservoir to the pumping station were received from W. P. Whitten, McRitchie & Nichols, Louis Kettleson and W. H. Barker. The first was the lowest at $43 per ton.

Minnesota.—Mankato. The Board of Public Works will extend the water-pipe system.——Two Harbors. Proposals for the construction of water-works will be received by A. H. BLAKE, Chairman of the Council, or F. E. DUNCAN, City Attorney.—— Duluth. The Duluth Gas & Water Co. has received a large consignment of pipe. ——St. Paul. The 30-in. main from the high service reservoir broke last week, but was soon repaired.

Kansas.—Argentine. The water company will soon commence work on its plant.——Bunker Hill. Water bonds to the amount of $6,500 have been registered with the State Auditor.

Nebraska.—Grant. The Lincoln Land Co. will build the water-works at a cost of $10,000. The bonds have been registered.——Lincoln. A second well, with new pumping plant, is said to be needed.

Missouri.—Kansas City. The water company will lay a temporary line of 15-in. screw-joint pipe across the Kaw river bridge of the Metropolitan Cable Co.——Marceline. A Worthington pumping plant of 1,500,000 galls. capacity per day will be put in.

Arkansas.—Jonesboro. The City Council wants propositions for establishing water-works.——Batesville. The Batesville Water & Electric Light Co. will put in its plant this year.

Texas.—Cleburne. The bonds for $50,000 issued in 1884 for the present water-works have been declared invalid by the U. S. Supreme Court, owing to some error in drawing them up; and they cannot legally be collected. ——Lockhart. The works are being enlarged at a cost of $3,000. A 20,000 gall. steam pumping engine has been put in.——Greenville. The new works were tested May 23.—— Temple. The Temple Water Co. has let a contract to a St. Louis firm to furnish and lay 6½ miles of pipe.—— Kerrville. Water-works are being built by Chas. Schreiner; there will be a tank of 20,000 galls. capacity.—— Marshall. The stand-pipe is completed.

New Mexico.—Albuquerque. The water-works are to be improved.

California.—Tulare. The Tulare Water Co. has received a compound, duplex pumping engine of 1,100 galls. capacity per minute, from Buffalo, N. Y.——Yuba City. The Yuba City Water Co. has been organized by A. B. VAN ARSDALE, J. P. EWELL, JAMES ORR, BAXTER WILCOXON, and W. H. PHILLIPS. Capital stock, $25,000. A 50,000-gall. tank will be built on a tower 20 x 40 ft. base. Work is to be commenced at once.

Canada.—Collingwood, Ont. The following bids were received by the Water Committee: McQuillan & Co., Toronto, $56,344 or $70,144; M. Boland, Collingwood, $62,100; J. H. Armstrong, Toronto, $64,200; Miles, Hunting & Co., Hamilton, $75,779; James Lindsay, Collingwood, $62,500; G. A. Brown, Trenton, $90,135.

Special Reports of Water-Works Construction.

Johnstown, Pa.—The Johnstown Water Co. informs us that they are now laying about four miles of 36-in. pipe to bring in the Stony-Creek supply. Brown & Emery are the contractors for tunneling and pipe-laying. The pipe is furnished by R. D. Wood & Co., of Philadelphia. The work is being done under the supervision of the Superintendent of the Johnstown Water Co., JAS. WILLIAMS. About 4,000 ft. of 4-in. street mains will be laid this summer.

Suffolk, Va.—G. H. COLEMAN, Superintendent of the Portsmouth & Suffolk Water Co., Portsmouth, Va., sends the following:

Work was begun in March, and is now nearly finished, with JOHN MCNAMEE as general contractor. There will be six miles of mains and 35 hydrants. The yearly rental for the latter is $75 each. Pipe and specials are from R. D. Wood & Co., and Coffin valves are used. L. B. WARD is Designing and C. D. WARD Constructing Engineer.

The supply is taken from the pumps at this point which force water through a long main to Portsmouth. The Davis pumps are soon to be changed, and Stout, Mills & Temple are furnishing a water-wheel.

Fort Valley, Ga.—J. D. MARSHALL sends the following:

The Fort Valley Water Co. intends to sink an artesian well at once, and put in water-works at a cost of $15,000. If a flowing well cannot be obtained, water will be pumped. Population, about 2,500.

Knoxville, Tenn.—We are indebted to A. H. MARTIN, Superintendent, for the following:

West and North Knoxville have recently been incorporated as cities, and it is probable that the Knoxville Water Co. will soon add to its pipe lines in these cities, and place 24 hydrants. There will also be added to the plant two new horizontal, tubular steel boilers, each 16 by 54 ft., with 64 tubes 3 ins. in diameter. A new iron stack will also be erected.

Franklin, Ind.—FRANK MCCULLOUGH has sent us the following:

The population is estimated to be 5,000. The Franklin Water Co. has partially organized with JAS. O'NEIL as Manager. The capital stock will be $60,000, in addition to which bonds will be issued. Contracts will be let by July 1. Water will be pumped from wells to a stand-pipe.

DuQuoin, Ill.—J. SOLOMON informs us that plans and specifications for works to be built by a private company will soon be ready, and that contracts will probably be let within 60 days. Water will be pumped to a stand-pipe, the source being surface water collected into a pond. Population, about 4,000.

Llano, Tex.—W. W. Knowles & Son, owners of the present water-works, report that they are contemplating the erection soon of large works.

Temple, Tex.—GEO. E. WILCOX, President, writes that the Temple Water Co. has just closed a contract for a pipe extension of 6½ miles to Leon river, and has also ordered 6 miles of pipe for distribution in the village. The company expects to bond its works for $50,000. The present extensions will cost $60,000.

Mammoth Springs, Ark.—The following information is from ROB'T GREER, President of the Mammoth Springs Water, Light & Motor Co.:

The above company proposes to build works immediately at a cost of $20,000. Water will be taken from Mammoth Spring, which is estimated to have a daily flow of 400,000,000 galls. Population, 1,000.

Roseburg, Ore.—N. P. BUNNELL has given us the following:

The Roseburg Water Co. began construction May 20, and will put its work in operation Sept. 1. J. MCQUINN, of Portland, Ore., is engineer for the company. Water will be pumped from the South Umpqua river to a 600,000-gall. reservoir, the power to be furnished by a water-wheel in a flouring mill. T. R. SHERIDAN is the principal officer of the company. The works are estimated to cost $20,000. A 30-years' exclusive franchise has been granted, and the city will pay an annual hydrant rental of $100 each. Population, $2,000.

Santa Cruz, Cal.—W. H. DUKE, President of the Santa Cruz Water Co., has sent the following:

Large quantities of new mains are now being laid, and a new reservoir is being built with a capacity of 4,000,000 or 5,000,000 galls. The city wishes to buy the works, but an agreement cannot be made as to the price. The city has voted $300,000 for the construction of works, but is having trouble about obtaining water.

What Water-Works Men say of The Manual of American Water-Works.

Your description of our works in the Manual is very correct.—H. G. HOLDEN, Supt. Nashua (N. H.) water-works.

Permit me not only to thank you for the Manual received a few days ago, but to say that in my judgment I do not see how a water board could conveniently dispense with its use.—A. H. HUBER, Sec'y Westminster (Md.) Water Co.

The book is too valuable to any department to delay giving needed information, and prompt response should be given.—JNO. R. TODD, Registrar, Norfolk (Va.) water-works.

I have received your Manual of American Water-Works for 1888. Just the thing I wanted, full of statistics and information. A big thing for small money. Put me down for next (1889) issue. Please send money order for same.—FRED ALSTERLUND, Chief Engineer and Superintendent, Moline (Ill.) water-works.

I am in receipt of your valuable book on water-works, for which please accept my thanks. Please send me another copy and bill for same as soon as possible.—JAMES P. DONAHUE, Secy., Davenport (Ia.) Water Co.

It is the best work, and a better account of water-works than all others.——JAMES M. BRELSFORD, Lessee, Deadwood (Dak.) Water-works.

We have your Manual of American Water-Works. We find the work complete, and the most satisfactory ever published.—THE MICHIGAN PIPE CO., Bay City, Mich.

Your Manual received. I expect to derive a great deal of valuable information from the same.—CHARLES HOOD, Supt., Burlington (Ia.) Water Co.

The information in nearly every instance is correct, and will be of great benefit to us.—F. W. BIRDSALL, owner. Auburn (Cal.) Water-Works.

[Correct and complete reports insure correct information in the Manual.—EDITOR.]